HURRICANE EVACUATION CORRIDOR STUDY TO CONNECT RELOCATED US 90 TO LA 3127

State Project No. 700-99-0132
Terrebonne, Lafourche, Assumption, St. James,
St. John the Baptist, St. Charles, and St. Mary Parishes

Prepared for:

Louisiana Department of Transportation and Development

Prepared by:

URS Greiner Woodward Clyde
3500 N. Causeway Blvd., Suite 900
Metairie, Louisiana 70002
(504) 837-6326

In Association With:

GeoQuery, Inc. and
R. Christopher Goodwin & Associates

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Notice to the Reader:

This report provides a feasibility study of alternative corridors for hurricane evacuation from the designated service area and is intended to provide the LDOTD with recommendations for future study. This report is conceptual in nature and is not to be used as the sole basis for final design or construction. Background information, design bases and other data have been furnished to URS Greiner Woodward Clyde (URSGWC) by the LDOTD and/or third parties, which URSGWC has used in preparing this report. URSGWC has relied on this information as furnished, and is not responsible for and has not confirmed the accuracy of this information. This report has been prepared based on certain key assumptions made by URSGWC which substantially affect the conclusions and recommendations of this report. These assumptions, although thought to be reasonable and appropriate, may not prove true in the future. URSGWC conclusions and recommendations are conditioned upon these assumptions.

EXECUTIVE SUMMARY

The proposed project is the establishment of a new or improved hurricane evacuation alternative to serve Terrebonne, Lafourche, Assumption, St. James, St. John the Baptist, St. Charles, and St. Mary parishes in southeastern Louisiana. The need for a new or improved route to provide hurricane evacuees a safe and reliable route to safety is underscored by many instances of inundation of portions of roadways and traffic congestion along existing hurricane evacuation routes. The primary purpose of this project is to improve hurricane evacuation efficiency by providing improved traffic flow and reduced congestion and delay in the event of a hurricane evacuation. The proposed project may have secondary benefits such as enhancing the efficiency of goods movement and improving access into and out of the region thus promoting economic development and facilitating the tourism industry; however, the analysis presented in this study was performed based solely on the purpose and need of improving hurricane evacuation efficiency within the defined service area.

The primary objective of this corridor feasibility study is to identify environmental issues for consideration and to develop reasonable and feasible alternatives for improving hurricane evacuation efficiency (construction and other) while avoiding where practicable and minimizing where unavoidable impacts to sensitive resources and ambient standards. The result of the study is the identification of alternative corridors that appear to be both reasonable and feasible and worthy of further consideration as the preferred alternative to address the stated purpose and need for the project.

The methodology for this study focused on the collection of existing geo-referenced data for use in large-scale, constraints-mapping exercises. However, effort was first expended in collecting and organizing data that support the purpose and need for the project. The first of two public meetings was held in October 1997. Comments from these meetings were used in tandem with agency comments, both written and verbal, to expand the study limits, develop alternatives for consideration and to initiate quantitative transportation analysis that provides more refined, supportive data for use in comparing alternative proposals.

Environmental issues of concern were identified using knowledge of potentially significant issues for the area. Geographic Information System (GIS) data were obtained and developed for the project area. Environmental constraints on development were then mapped on a satellite image of the study area, which was used to develop reasonable and feasible alternative segment corridors. These alternative segments were aggregated into composites that evolved into the currently evaluated alternatives. After composite alternatives were identified, a transportation hurricane evacuation model (customized TRANPLAN model) was then prepared for the hurricane evacuation service area consistent with similarly prepared evacuation models for other coastal areas. Preliminary alternatives were then simulated as future, built transportation routes. Relative congestion among the alternatives was determined and compared. The transportation analysis resulted in the following conclusions and recommendations: 1) The evacuation time is controlled by the critical links; 2) A connection to the Gramercy-Wallace Bridge

is needed; 3) The alternatives that best meet the hurricane evacuation purpose and need are those that uniformly distribute traffic between critical links and maximize the efficient utilization of other hurricane evacuation corridors; and 4) improvements to the US 90 east of Raceland would not substantially benefit hurricane evacuation efforts within the study area because such improvements would attract westbound trips from New Orleans and eastbound trips from the Thibodaux-Houma area. Therefore, improvements to US 90 East must be accompanied by improvements to US 90 West in order to improve hurricane evacuation efficiency.

Costs of each alternative were then prepared by applying design assumptions and costs, by section type, per embankment mile and per elevated mile costs. Other cost related issues such as right-of-way acquisition and mitigation, were estimated using per acre assumptions and information obtained from Federal and State agencies.

The alternatives were then reviewed in relation to the identified constraints on development, with estimations of probable effects of final alternative corridor alignments for the identified alternative corridors for consideration. Table S-1 provides a summary of the constraints and evaluation issues that were taken into consideration for the alternative corridor evaluation.

Alternatives were then evaluated to determine which alternatives if any, most effectively met the stated project purpose and need and could be considered both reasonable and feasible. Alternatives that clearly did not meet the intended project purpose and need and/or were determined not to be reasonable or feasible were eliminated from further consideration. Alternatives that were eliminated from further considerations included Alternatives 1, 1A, 2, 3, and 5. These alternatives were eliminated from further consideration for future study mainly because they did not meet the primary transportation objective of improving hurricane evacuation efficiency. Several alternatives (e.g., Alternatives 2 and 3) also had potentially high numbers of relocations and/or potential impacts to listed or eligible for listing historic properties and potentially hazardous sites.

Based on the stated primary purpose and need of improving hurricane evacuation efficiency, and the documented evaluation considerations, Alternative Corridors 6, 6A and 7A appear to be the most effective and reasonable. All three of these alternative corridors are on new location.

The estimated total project costs including construction, engineering, administrative, right-of-way, mitigation and contingencies for these three alternatives range from $313 million to $404 million. However, it should be noted that these are total project costs for a network extending from Relocated US 90 to I-10, which includes a vast array of improvements including constructing a new approach connector to the Gramercy-Wallace Bridge from LA 3127, widening LA 641 to I-10, upgrading LA 3127 between the Sunshine Bridge and the Gramercy-Wallace Bridge and building a new four-lane facility from Relocated US 90 to LA 3127.

TABLE S.1. Summary of Alternative Corridors Conserations

See filename TABLES_1.PDF

This table summarizes all factors that were considered in the study's evaluation of the preliminary alternatives and provides these considerations in a matrix, by alternative. This table is identical in data and format to that of Table 5.1.

Each of the three identified preferred hurricane evacuation alternative corridors was evaluated for logical phasing options to determine the most beneficial segments (projects) and a logical sequence for implementation. Also, with a phased implementation, full capital funding to implement the entire project is not required initially, and phases can be scheduled and programmed more consistent with anticipated funding resources availability. The results of this evaluation revealed that there are "Interim Alternative Concepts" that could potentially provide significant hurricane evacuation benefits while minimizing initial costs.

These "Interim Alternative Concepts" are similar and are comprised of partially implementing the three most critical segments of the preferred alternative corridors including:

1) Construction of a new connector roadway from LA 3127 to the Gramercy-Wallace Bridge.
2) Implementation of a new two-lane roadway from LA 3127 to LA 1 (substantial portion will be elevated).
3) Implementation of a new two-lane roadway from LA 1 to Relocated US 90.

These three segments would need to be implemented with reasonable control of access, to operate an outbound reversible lane facility with minimal manpower requirements. By utilization of reasonable control of access measures, intelligent transportation systems technology, and proper planning, a Traffic Management Plan can be devised that minimizes manpower requirements and allows for implementation and operation of the reversible facility concept for hurricane evacuation events.

The following is a listing of each preferred alternative corridor with costs by interim alternative critical segments.

Table S.2. Interim Alternative Program Cost for Preferred Hurricane Evacuation Alternatives corridors

Alternative	Improvement Description	Project Length (mi.)	Total Project Cost minus Mitigation ($Millions)
6	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
6	LA 308 to LA 3127: Elevated New 2-Lane Road	7.6	86.0
6	LA 308 to LA 3127: New 2-Lane Road	3.3	8.6
6	US 90 to LA 308: Elevated New 2-Lane Road	2.9	33.0
6	US 90 to LA 308: New 2-Lane Road	7.0	25.4
Total			**175.5**
6.A	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
6.A	LA 308 to LA 3127: Elevated New 2-Lane Road	8.7	92.1
6.A	LA 308 to LA 3127: New 2-Lane Road	2.8	8.1
6.A	US 90 to LA 308: Elevated New 2-Lane Road	2.9	33.0
6.A	US 90 to LA 308: New 2-Lane Road	7.0	25.4
Total			**181.1**
7.A	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
7.A	LA 1/LA 308 to LA 3127: Elevated 2-Lane New Road	7.6	86.0
7.A	LA1/LA 308 to LA 3127: New 2-Lane Road	4.6	6.3
7.A	US 90 to LA1/LA 308: New 2-Lane Road	9.3	22.4
Total			**137.2**

Notes: Projects listed comprise the Interim Alternative Concept of the fully-envisioned alternatives as described in Section 2.0 of this report. Full Alternative costs are described in Section 2.0 of the report.

Source: Original cost calculation data sources on tables 2.2 through 2.5 of this report.

Estimated costs to implement these "Interim Alternative Concepts" vary from approximately $137 million to $181 million, approximately 40 percent of the estimated total project costs. Based on the transportation modeling analysis the following priority phasing is recommended:

1) Construction of a new connector roadway from LA 3127 to the Gramercy-Wallace Bridge.
2) Implementation of a new two-lane roadway from LA 3127 to LA 1.
3) Implementation of a new two-lane roadway from LA 1 to Relocated US 90.

Ultimately, additional phases of the chosen Alternative can be implemented over time consistent with available funding levels until the full scope of the project is completed.

The following is a summary of the primary reasons that Alternative Corridors 6, 6A and 7A were identified as the preferred hurricane evacuation alternative corridors:

1) These alternatives most effectively meet the stated purpose and need of improving the efficiency of the hurricane evacuation transportation network and generally the efficiency of hurricane evacuation events within the defined service area.

2) Considering the two defined northbound hurricane evacuation critical links (the Sunshine and Gramercy-Wallace Bridges), these alternatives provide a relatively uniform distribution of hurricane evacuation traffic demand, maximizing the efficient utilization of these critical links.

3) Each of these Alternative Corridors effectively utilize the upland natural ridge system within the study area to minimize impacts to wetland areas. When expansive wetland areas are traversed, elevated roadway sections are assumed in order to minimize impacts to wetland areas.

4) Each of these Alternative Corridors primarily entails construction on new location in undeveloped or sparely developed corridors resulting in minimization of impacts to community and cultural resources.

5) Good access and proximity to population centers within the service area are provided by each of these alternative corridors.

6) They provide options and good flexibility in accessing designated hurricane evacuation shelter zones to the north as well as other primary hurricane evacuation routes to the north of the study area.

7) Each of these alternatives provide the opportunity for a phased implementation approach in which defined interim alternatives could be developed which could potentially provide significant hurricane evacuation benefits while greatly minimizing initial costs.

Other Considerations

The primary purpose and need for this study was defined as hurricane evacuation. When evaluating all of the alternative corridors developed for consideration solely based on the hurricane evacuation purpose and need for this project, Alternative Corridors 6, 6A and 7A rate similarly and better than the other alternative corridors and are, therefore, considered the preferred alternative corridors. However, there are other secondary purpose and need issues that local community governments, agencies and other stakeholders have expressed and may want considered in future evaluations. If the purpose and need for this project is modified, the preferred alternative corridor recommendations in this study may need to be modified to be consistent with changes in the stated purpose and need for the project.

Two of the alternative corridors (Alternatives 4 and 7) considered in this analysis were not explicitly eliminated from consideration in Section 5.2, nor were they included as preferred alternative hurricane evacuation corridors. Because modifying the documented purpose and need of the project is a consideration, these alternatives are noted for further consideration, contingent on this potential modification of the project purpose and need.

Summary of Study Conclusions

In summary, the study supports the following conclusions:

1) Hurricane evacuation time is controlled by critical surface transportation links;

2) Connection to the Gramercy-Wallace Bridge is the most important critical surface transportation link;

3) Evenly distributing traffic between the Sunshine Bridge and the Gramercy-Wallace Bridge is the primary objective to efficiently utilizing hurricane evacuation corridors in the study area;

4) Improvements to the US 90 east of Raceland would not substantially benefit hurricane evacuation efforts within the study area because such improvements would attract westbound trips from New Orleans and eastbound trips from the Thibodaux-Houma area. Therefore, improvements to US 90 East must be accompanied by improvements to US 90 West in order to improve hurricane evacuation efficiency.

5) An "Interim Alternative Concept" comprised of the most beneficial elements of the preferred alternative could substantially benefit hurricane evacuation at a reduced cost and implementation time;

6) Alternative Corridors 6, 6A, and 7A are preferred alternative corridors because a) they most effectively meet the purpose and need for hurricane evacuation, b) they most evenly distribute traffic between the Sunshine and Gramercy-Wallace bridges, c) they minimize impacts to wetlands with use of elevated sections and alignments through upland areas, d) they have minimum impacts to established communities and cultural resources, e) they provide options and flexibility in accessing shelter areas north of the project area, and f) they provide good opportunities for the phased approach or "Interim Alternative Concept"; and

7) Should the purpose and need of the study be expanded to include other objectives than hurricane evacuation, Alternatives 4 and 7 should be revisited as potential, preferred alternative corridors.

Details regarding these conclusions are addressed in Sections 4 (Alternative Corridor Constraints) and 5 (Conclusions) of this report.

Public Response to Study Conclusions

The second and last public meeting for the project was held in April 1999. The study results and conclusions were presented at this meeting, followed by a question and answer session. Details regarding this meeting are contained in Section 2 (Alternatives Development) of this report. Three resolutions in support of an eastern alignment for the project (i.e., Alternative 7 or 7A) were received, with one of the resolutions in specific support of Alternative 7. Verbal statements of the public were also in support of an eastern alignment rather than a western alignment for the project (i.e., Alternatives 7 or 7A rather than Alternatives 6 or 6A). Written statements were likewise in support of Alternative 7 as well as 7A. However, one written statement from a resident opposed the alignment of Alternative 7 and Alternative 7A south of LA 1. Among the requests of the public to LDOTD was the request to revise the purpose and need of the project from solely hurricane evacuation to include other objectives such as goods movement and daily utility. It was also requested that the project objective of Hurricane Evacuation not be changed and that the criterion of providing the best hurricane evacuation continue to be the only criterion for selection. It was explained in the public meeting that the purpose and need for this project will not be revised because of the study funding purpose; however, should future funds be made available for further project development for purposes other than hurricane evacuation, LDOTD would consider modifying the purpose and need for the project. Responses to other public requests are provided in Section 2 of this report. No other public meeting or involvement opportunities are scheduled for the corridor phase of this project, which is complete with the production of this final report.

EXECUTIVE SUMMARY

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1.0 INTRODUCTION

1.1 Purpose and Need

1.1.1 Project Location and Description

The proposed project is the establishment of a new or improved hurricane evacuation alternative to serve Terrebonne, Lafourche, Assumption, St. James, St. John the Baptist, St. Charles, and St. Mary parishes in southeastern Louisiana. The study area is traversed by numerous natural ridges associated with rivers and bayous. The ridges are typically long and relatively narrow with expansive wetlands areas in-between. Population is typically concentrated along these natural ridges, with highest population concentrations along the Mississippi, Terrebonne and Lafourche ridges. The largest population center within the study area is the municipality of Thibodaux. There are numerous other smaller communities located within the study area.

Figure 1.1 displays the location of the original and expanded study area (discussed in Section 2.0 of this report) in relation to the State of Louisiana. The project study area spans from Relocated US 90 in south-central Louisiana to I-10, north of the Mississippi River. The western study limits are generally composed of the upper segment of the Lafourche ridge extending south to relocated 90 along the Lafourche, Terrebonne and St. Mary Parish line. The eastern boundary is a north-south line between relocated US 90 and I-10, east of Thibodaux, from approximately Raceland to Reserve.

Figure 1.1 Location Map
See filename FIG1_1.PDF

This figure displays the project's study area in relation to the State of Louisiana.

1.1.2 Hurricane Evacuation Network

Existing System

Terrebonne, Lafourche, Assumption, St. James, St. Mary, St. John the Baptist, and St. Charles parishes are located in south central Louisiana. The only primary arterial access to the parishes of Terrebonne, Lafourche, Assumption, and St. Mary is US 90 from the east and west and LA 1 from the north and west. The westbanks of St. John, and St. James parishes are serviced by LA 3127. While transportation access to the region has been somewhat limited, with no direct interstate access, substantial population and employment growth has been experienced in the region. In the 1960's, 70's and early 80's, the region saw explosive economic growth related to the oil and gas industry. Significant increases in population and employment were recorded over this period. Between 1960 and 1990 the population in the seven parish area including Lafourche, Terrebonne, Assumption, St. Mary, St. Charles, St. James and St. John parishes increased by over 125,000 persons or approximately 55 percent. While growth slowed during the mid and late 1980's due to a recession in the oil and gas industry, the economy once again began to improve in the 1990's due to diversification and improvements in the oil and gas sectors, resulting in substantial population and employment growth. The most significant transportation improvements over the last 40 years relative to accessing the region and hurricane evacuation has been improvements to US 90 to the east (upgraded from a two- to a four-lane facility) and ongoing improvements to US 90 to the west. As noted in Figure 1.2, the only designated evacuation routes for area residents are LA 1/LA 308 and US 90, which generally travels east to west. LA 70, a circuitous two-lane route

Figure 1.2 Designated Hurricane Evacuation Routes

See filename FIG1_2.PDF

This figure displays the present, designated, regional hurricane evacuation surface transportation network located within the region of Louisiana that was incorporated into the transportation demand model for the study. This transportation demand analysis evaluated the hurricane evacuation effectiveness of the preliminary alternatives.

also provides some evacuation capacity north to Interstate 10 and US 61 for St. Mary and Assumption parishes; however, no other designated north-south evacuation route exists to serve this area.

LA 1 and LA 308 are two-lane arterials that parallel both the east and west banks of Bayou Lafourche from lower Lafourche to the Mississippi River. With unlimited access and heavy commercial and residential development associated with numerous small and mid-sized municipalities, unimpeded travel is difficult along these arteries. Additionally, the numerous access points along these roadways renders temporarily operating the facility as a two-lane northbound facility during evacuations very difficult to implement.

US 90 is a principal arterial and the major east-west corridor in southern Louisiana. US 90 is a four-lane divided arterial to the east; however, improvements to upgrade US 90 to the west to four lanes are not complete. Documented closures of US 90 between Raceland and Des Allemand caused by inundation greatly reduce the utility of this roadway for hurricane evacuation. US 90 connects Lafourche, Terrebonne, Assumption and St. Mary Parishes with I-310 and I-10 toward New Orleans to the east and Lafayette, I-10 west and I-49 to the west. Presently, this corridor is heavily traveled with uncontrolled access and at-grade signalized intersections along certain segments between New Orleans and Lafayette that result in substantial delay and inefficiencies. LA 70 provides access to the Sunshine Bridge from LA 1 and LA 308 and also services portions of Assumption and St. Mary Parishes. Critical segments of this portion of LA 70 are

only two lanes, which greatly reduce the capacity to service hurricane evacuation traffic between LA 1 and the Sunshine Bridge.

Needed System Improvements

The low elevations of the southeastern Louisiana terrain render it highly susceptible to flooding during heavy precipitation events, high tides, and storm surges. With the passage of time, better record keeping on past storms, and the readily disseminated storm damage reports through television, the computer, and the newspaper, hurricanes are beginning to be taken more seriously by the public. Where once evacuations were often ignored by the public, who chose instead to "ride-out" the storm, the public is now reacting more positively and quickly to hurricane evacuation warnings.

Although Louisiana has experienced many strong hurricanes during historic times, more recently, two hurricanes have provided evidence of much needed access and capacity improvements along evacuation corridors: Hurricane Andrew, which struck the south-central coast of Louisiana in 1992; and Hurricane Georges, which impacted the coastline in 1998. The combination of susceptibility to flooding, improved public education of the effects of hurricanes, and significant increases in coastal populations have resulted in the need for improved hurricane evacuation.

Hurricane Andrew (September 1992). During Hurricane Andrew, it was estimated that 1,250,000 people evacuated from the parishes located in southeastern Louisiana. It is interesting to note that there was not much lead time between the first official posting of a

hurricane *watch* for south central Louisiana and Hurricane Andrew actually making landfall; 43 hours. Only 24 hours spanned between the first hurricane *warning* advisory and landfall, and according to some accounts, many travelers were stranded in their vehicles on the roadways when Andrew made landfall.

Hurricane Georges (September 1998) On September 17, 1999, a tropical system in the Atlantic Ocean reached hurricane status and was issued the name Georges. Two days later Hurricane Georges had become a Category 4 on the Saffir-Simpson scale, with a maximum wind speed of 146 knots. It then moved on a northwesterly track through the Caribbean, crossing many of the Caribbean islands, Puerto Rico, the Dominican Republic, Haiti, and Cuba before taking a more north-northwesterly track into the Gulf of Mexico. Weakening of the storm due to numerous landfalls throughout the Caribbean caused Hurricane Georges to be downgraded to a Category 2 by the time it entered the Gulf of Mexico. During September 26 and 27, the forward speed of Hurricane Georges gradually decreased. The hurricane narrowly missed a direct hit of southern Louisiana, finally making landfall to the east in Biloxi, Mississippi on September 28, 1999, having an estimated maximum sustained one-minute winds of 90 knots and a minimum central pressure of 964 mb.

The first hurricane *watch* to include southern Louisiana was issued at 3:00 P.M. on September 25, 1998 for the areas on the Gulf Coast from Morgan City, Louisiana to St. Marks, Florida. At 3:00 P.M. on September 26, 1999, a hurricane *warning* was issued for areas east of Morgan City, Louisiana to Panama City, Florida. At the same time a

hurricane watch was put in place for areas west of Morgan City, Louisiana to Intracoastal City, Louisiana. The National Hurricane Center (NHC) downgraded the hurricane warning to a tropical storm warning for the areas between Grand Isle, Louisiana and Morgan City, Louisiana on September 28, 1998 at 3:00 P.M. Six hours later at 9:00 P.M. the NHC changed the hurricane warning to a tropical storm warning for the areas of Grand Isle, Louisiana to Destin, Florida, in addition to discontinuing the tropical storm warning for the areas between Grand Isle and Morgan City, Louisiana. On September 29, 1998, at 3:00 A.M. the tropical storm warning was discontinued for Grand Isle, Louisiana to the mouth of the Mississippi River. The next update from the NHC discontinued the tropical storm warning for the mouth of the Mississippi River to Pascagoula, Mississippi.

Preliminary estimates on the storm surge for areas along the central and eastern gulf coast range from 5 – 9 feet in Louisiana and Mississippi to 5 – 12 feet in Alabama. A maximum storm surge of 8.9 feet was recorded in Point-a-la-Hache, Louisiana. The eastern portion of Lake Pontchartrain, at the Rigolets, recorded a storm surge of 5.8 feet, while the mid (Pontchartrain Causeway) and western (Frenier) portions of the lake experienced surges of 4.7 feet.

It is estimated that during the time that Hurricane Georges was due to make landfall along the Louisiana/Mississippi Gulf Coast, one third of Orleans and Jefferson Parish residents evacuated to places outside of both parishes. Most of the 33 percent of people who evacuated, waited until 24 – 30 hours before the storm's projected landfall to leave

the area. This delay by residents loaded southeastern Louisiana's highway system to capacity, creating tremendous traffic problems and delays. An unusually wet September also caused problems during the Hurricane Georges evacuation. Large amounts of rain and high tides from Tropical Storm Francis inundated portions of US 90, making the primary east-west evacuation route virtually impassible. Prior to Hurricane Georges threatening southeastern Louisiana, Governor Foster ordered sandbags and pumps placed along US 90 in an effort to free the roadway from water and open it to traffic.

1.1.3 Summary of Project Need and Project Purpose

The need for a new or improved route to provide hurricane evacuees within the designated service area a safe and reliable route to safety is underscored by many instances of inundation of portions of roadways and traffic congestion along the limited number of existing hurricane evacuation routes. The primary purpose of this project is to improve hurricane evacuation efficiency by providing improved traffic flow and reduced congestion and delay in the event of a hurricane evacuation. The proposed project may have secondary benefit such as enhancing the efficiency of goods movement and improving access into and out of the region, thus promoting economic development and facilitating the tourism industry; however, the analysis presented in this study was performed based solely on the purpose and need of improving hurricane evacuation efficiency within the defined service area.

1.2 Study Objectives

The primary objective of this corridor feasibility study is to identify environmental issues for consideration and to develop reasonable and feasible alternatives for improving hurricane evacuation efficiency (construction and other) while avoiding where practicable and minimizing where unavoidable impacts to sensitive resources and ambient standards. The result of the study is the identification of alternative corridors that appear to be both reasonable and feasible and worthy of further consideration as the preferred alternative to address the stated purpose and need for the project.

1.3 Study Approach

It was recognized that the study is a corridor feasibility study, early in its conception. The methodology for this study focused on the collection of existing geo-referenced data for use in large scale constraints-mapping exercises. Effort was first expended in collecting and organizing data that support the purpose and need for the project. The general project study area in need of the facility was then identified, with general borders drawn that provided reasonable areas within which new location construction alternatives could be located. A public and agency involvement plan was prepared that included two Public Meetings and other agency meetings. The first of these Public Meetings was scheduled and held in October 1997. At this meeting, the general proposal and purpose and need statement for the project was introduced with a presentation of the study approach. Comments from this meeting were used in tandem with comments from an associated resource agency meeting to expand the study limits, develop alternatives for

consideration and to initiate quantitative transportation analysis that provides more refined, supportive data for use in comparing alternative proposals.

Environmental issues of concern were identified using knowledge of potentially significant issues for the area. Geographic Information System (GIS) data were obtained and developed for the project area. GIS resources and issues that were reviewed include the locations of development and communities, public lands, sensitive structures, archaeological sites and historic structures, prime and unique farmland soils, coastal zone boundaries and floodplains, recorded hazardous waste handling and storage/disposal sites, surface waters, wetlands, and Louisiana Natural Heritage Program sensitive sites. Environmental constraints to development were then mapped on a satellite image of the study area, which was used to develop reasonable and feasible alternative segment corridors for consideration consistent with stakeholder comments, environmental constraints, and the stated project purpose and need. These alternative segments were aggregated into composites that evolved into the currently evaluated alternatives (1, 1A, 2, 3, 4, 5, 6, 6A, 7, and 7A).

After composite alternative corridors were identified, a transportation demand model (customized TRANPLAN model) was then prepared for the hurricane evacuation project consistent with similarly prepared evacuation models for other coastal areas (See Section 3.0 for a summary of this transportation analysis). Preliminary alternatives developed using least-impact corridors within the project area were then simulated as future, built

transportation routes. Relative efficiency and congestion among the alternatives was determined and compared.

Costs of each alternative were then prepared by applying design assumptions and costs, by section type, per embankment-mile and per elevated-mile costs. Other costs (i.e., right-of-way costs and wetlands mitigation preservation costs) were estimated using per acre assumptions and information obtained from Federal and State agencies.

After alternatives' costs were estimated and effects projected, the study team used the traffic modeling results and impacts of each alternative to subjectively evaluate which alternatives met the intended project purpose, were reasonable and feasible and should be further considered in future project development phases. Alternatives were ranked based on several criteria. Opportunities to phase-in the alternatives in an interim and long range concept were also investigated. The results of the final evaluation were then provided in a conclusion section.

2.0 ALTERNATIVES DEVELOPMENT

2.1 Public and Agency Involvement

The first public meeting for the project was held at the Nicholls State University Campus Ballroom in the Student Union at 6:30 P.M. on Tuesday, October 28, 1997. This meeting was attended by LDOTD, FHWA, and consultant staff, as well as over 60 citizens. A brief summary of the study's objectives was provided, followed by a technical presentation regarding the evaluation that had been conducted to date. Fourteen individuals made statements regarding the project at the meeting. All acknowledged the evacuation and safety need for the facility, and most recognized the potential economic, induced benefits from such a facility. Representatives from several communities, however, had concerns regarding community impacts with different alternative corridors. Twenty-five individuals responded with written comments. All commentors were in support of a north-south corridor to facilitate evacuation. Commentors were divided regarding whether a new location route should be either east or west of Thibodaux, Louisiana. Citing commerce shipping needs, most commentors, who had local industrial interests, noted that an alignment east of Thibodaux that connects with the Gramercy-Wallace bridge would be desirable. In addition to these general comments, several commentors noted that the study should include routing traffic over the Mississippi River to US 61 and I-10 rather than only evaluating evacuation to LA 3127, which was noted to be only part of the evacuation problem.

An interagency meeting was held November 20, 1997, with the U.S. Army Corps of Engineers, the Louisiana Division of Coastal Zone Management, the U.S. Fish and Wildlife Agency, the Louisiana Wildlife and Fisheries, and the National Marine Fisheries Service. In concurrence with the comments made in the Public Meeting, the agencies requested that the study area be expanded to include the area north to I-10 and US 61 and west to include LA 1, and LA 308, the corridor along the Lafourche ridge to the Sunshine Bridge. The agencies also requested that Transportation System Management (TSM) alternatives be considered. Additional analysis on this expanded study area was initiated in June 1998, which included a quantitative transportation modeling analysis to provide for more objective alternative comparisons. Details regarding the transportation modeling that was initiated for this project are contained in Section 3.0 of this document.

The second and last public meeting for the study was also held at the Nicholls State University Campus, in the Powell Hall Auditorium at 6:00 P.M., Thursday, April 29, 1999. The meeting was attended by LDOTD, consultant staff, and over 100 citizens. A brief summary of the study's analysis and conclusions was followed by a question and answer session. Thirteen persons made statements, and several others asked questions regarding the study's assumptions, considerations, and conclusions. The Greater Lafourche Port Commission and the LA 1 Coalition each submitted a resolution into the record supporting an alternative alignment parallel to LA 316 (Alternatives 7 or 7A). The St. James Parish Council submitted a resolution in support of Alternative 7. All verbal statements were in support of an eastern alternative alignment parallel to LA 316 (i.e., Alternatives 7 or 7A rather than Alternatives 6 or 6A). Most verbal statements were in

specific support of Alternative 7. However, notably, the City of Thibodaux is in support of Alternative 7A primarily because of its access to Nicholls State University and the Thibodaux Regional Hospital Complex and the additional evacuation access it would provide to the northeastern portion of the City. Twelve written comments were received. Five of the twelve comments specifically supported Alternative 7. Two of these commentors specifically supported Alternative 7A. Most acknowledged the need for this roadway. Commentors in support for Alternative 7 emphasized that Alternative 7 had a lower cost, served more populated areas, and would provide better daily utility than other alternatives. Two commentors who supported Alternative 7 also suggested that it would provide the safest and shortest evacuation route for the Waterford III nuclear power plant located in Kilona, near the junction of LA 3127 and LA 3141. Additionally, most commentors supporting Alternative 7 suggested that it was the best evacuation route because it provides the most direct route to the presently underutilized Gramercy-Wallace Bridge. One resident opposed the alignment of Alternative 7 and 7A south of LA1 because it may traverse her property along LA 316.

Considerations that were requested of the public and officials included 1) both revising the purpose and need to include daily traffic operations and goods movement, and retaining hurricane evacuation as the only objective purpose and need for the study; 2) considering the effect of the Hale Boggs Bridge to hurricane evacuation efficiency; 3) considering the effectiveness of I-10 east of LA 641 in providing evacuation during storm surge events; 4) considering parallel routes that would serve the populated areas of Terrebonne and Lafourche; 5) providing information on the project schedule; 6)

reviewing conclusions regarding the effectiveness of Alternative 7 to provide hurricane evacuation; 7) and reviewing modeling assumptions regarding the existing network, especially the adequacy of LA 20. Responses to these requests are provided below.

1) *Both revising the purpose and need to include daily traffic operations and goods movement, and retaining hurricane evacuation as the only objective purpose and need for the study*. The purpose and need for this study is solely hurricane evacuation and will not be revised; however, should future funds be made available for further project development for purposes other than hurricane evacuation, LDOTD would consider modifying the purpose and need for the project.

2) *Considering the effect of the Hale Boggs Bridge to hurricane evacuation efficiency*. Because of the location of both the Sunshine Bridge and the Gramercy-Wallace Bridge to users in the modeled study area, the Hale Boggs Bridge would have little attraction to evacuees within this study area.

3) *Considering the effectiveness of I-10 east of LA 641 in providing evacuation during storm surge events*. I-10 east of Airline Highway is located only several feet above sea level. It is possible that hurricane storm surges may inundate portions of I-10, causing congestion and delay. However, it should be emphasized that the project's purpose and need is hurricane evacuation, and hurricane evacuation typically would take place in advance of the primary storm surge. Minor tidal flooding in advance of the hurricane is

not anticipated to affect I-10. Airline Highway (US 61) and I-10 Westbound are still viable options if I-10 East is closed due to inundation.

4) *Considering parallel routes that would serve the populated areas of Terrebonne and Lafourche*. Separate, parallel routes were not considered as a single alternative because of excessive cost and travel demand.

5) *Providing information on the project schedule*. The corridor feasibility study is complete. No other study, meetings, or public involvement opportunities are scheduled for this study. Should additional funding be identified for further project development, the LDOTD would prepare a scope of service consistent with the funding source and stated objectives. The time frame for the next phase of project development will be dependent on funding and the specified scope. If federal funds are to be utilized for project development, further environmental documentation, such as an EIS and the accompanying Record of Decision (ROD) from the Federal Highway Administration will ultimately be required prior to beginning preliminary and final design.

6) *Reviewing conclusions regarding the effectiveness of Alternative 7 to provide hurricane evacuation*. The travel demand modeling input and output were reviewed. It is apparent that Alternatives 7A, 6, and 6A provide greater hurricane evacuation efficiency than Alternative 7, primarily because these alternatives do not route the vast majority of south-central originating traffic over the Gramercy-Wallace Bridge. Rather,

Alternatives 6, 6A, and 7A uniformly distribute traffic flow between the two bridges, thereby more efficiently utilizing the existing roadway capacity.

7) *Reviewing modeling assumptions regarding the existing network, especially the adequacy of LA 20*. Although the adequacy of LA 20 is currently under review, capacity assumptions used in the travel demand modeling efforts for this study incorporated the existing substandard conditions of this roadway and existing urban development along this corridor. Therefore, no revisions to the model are needed.

2.2 Traffic Management Alternatives

The objective of hurricane evacuation rendered consideration of typical transportation management alternatives such as ride-share/car-pooling and others unreasonable. Evacuation-related traffic operations are already managed by the Office of Emergency Preparedness, which has issued hurricane evacuation route information to area residents and coordinates evacuations in the most efficient manner possible. Alternative 1 considered overlaying and adding shoulders to critical segments on LA 1, LA 308 and LA 70 to US 61 and to I-10 in order to improve the efficiency of the system. One operational alternative was considered in this study. Alternative 1A proposes to operate LA 308 and two lane segments of LA 70 as northbound only, during hurricane evacuations from the LA 308/Thibodaux Bypass junction to the Sunshine Bridge. These alternatives are explained more fully in Section 2.4.

2.3 No Action Alternative

The No Action, or No Build Alternative, is an alternative that must be evaluated as a reference alternative to which build alternatives are compared in the environmental documentation prepared under the National Environmental Policy Act. The No Action Alternative would not be associated with any improvements or additions to the existing hurricane evacuation transportation system. With the projected increases in population, employment and commercial activity in the south-central area of Louisiana, it is reasonable to assume that current transportation deficiencies associated with both daily and emergency travel along these southern arteries will only continue to worsen. Although this alternative would be evaluated under future environmental documentation, it should be noted that this alternative does not appear to meet the purpose and need for this project and would be associated with degraded driving conditions in the future.

2.4 Preliminary Alternative Segments

Environmental constraints (e.g., wetlands, historic properties, community facilities, and others) were provided on area maps to enable conceptual designs of alternative new construction corridors to be drawn that avoided where practicable and minimized where unavoidable, impacts to sensitive resources. Design criteria for new construction for this project included development of a principal arterial with design speeds of 55 to 70 mph; elevated sections through wetland areas and over water; and at-grade sections for upland construction. Preliminary Alternative segments were labeled and aggregated to develop section composites. Segments are displayed in Figure 2.1. Table 2.1 displays the

distance of each segment noted on Figure 2.1. Figures 2.2 and Figures 2.3 display the resulting preliminary alternatives overlain on the GIS and satellite image base maps, respectively.

Table 2.1. Alternatives' Segment Lengths

Segment	Length (Miles)
1	9.3
2	4.2
3	18.0
4	11.3
5	4.1
6	2.8
7	39.4
8	19.3
9	9.9
10	4.1
11	5.8
12	2.1
13	9.3
14	3.2
15	4.5
16	12.6
17	9.0
18	11.5
19	7.6
20	20.2
21	2.0
22	3.2
23	2.5

Note: Segment distances should be aggregated to determine distances of composite alternatives, refer to Figures 2.2 and 2.3 to illustrate which segments comprise such alternative.

Source: URS Greiner Woodward Clyde, 1999

2.5 Improvement Construction Alternatives.

In response to the Public Meeting held in October 1997, the project team began to investigate the feasibility and reasonableness of upgrading existing alignments within the hurricane evacuation corridor. Several roadways were studied, including, LA 1, LA 308, and LA 20, which provided the best opportunities for improvement options. LA 1 and LA 308 are heavily-traveled, full-access, two-lane facilities that lead to the Sunshine Bridge via US 70. These roads parallel Bayou Lafourche on each side in south-central Louisiana from the south to its junction with LA 3127. LA 20 is a two-lane facility that leads from Thibodaux to the Gramercy-Wallace Bridge via River Road, north of LA 3127. No other roadway and corresponding route was considered a feasible option to meet the evacuation needs of this project. A detailed description of each of the improvement construction alternatives follows.

2.5.1 Alternative 1

Alignment. The alignment of Alternative 1 is denoted in yellow on all figures with alternatives. Alternative 1 begins at its southern terminus at the junction of LA 24 with Relocated US 90/LA 3052. No improvements to LA 24 would be proposed through to its junction with LA 3185. This alternative would include adding a paved shoulder to either side of LA 3185 where not existing from this junction to its intersection with LA 1/LA 308 in an attempt to add some capacity with minimal improvements along these corridors. LA 308 and LA 1 would be overlayed and paved shoulders added where not existing between this juncture and the LA 70 spur to the Sunshine Bridge, I-10 and US 61. The design speed and operational characteristics of this roadway would remain

Figure 2.1 Preliminary Alternative Segments

See filename FIG2_1.PDF

This figure displays the locations and lengths of alternatives' segments for the preliminary alternatives.

Figure 2.2 Preliminary Alternatives

See filename FIG2_2.PDF

This figure displays the preliminary alternative corridors that were evaluated in this study in relation to the study area.

Figure 2.3 Preliminary Alternatives with Satellite Image

See filename FIG2_3.PDF

This figure displays the same information as Figure 2.2; however, it is overlayed atop a Satellite photograph of the study area. This figure is the only figure in the report that displays the Satellite photograph.

unchanged, and the entire alignment would remain largely uncontrolled access except on existing controlled-access sections of LA 70. Alternative 1 would also include a project to connect existing LA 3127 to the Gramercy-Wallace Bridge approach, which is proposed for all alternatives as a critical link improvement.

Intersections/Interchanges. Although Alternative 1 would involve improving associated roadways through overlay with paved shoulders, no other improvements or signal phasing changes would accompany this alternative along the affected segments of LA 311, LA 1 and LA 308. A new intersection would be required at the proposed junction of LA 3127 and the new Gramercy-Wallace connector road.

Railroad and Surface Water Crossings. The number of railroad and waterway crossings would not change between the No Build and Alternative 1. Seven existing railroad crossings along the LA 311/LA 1/308 corridor would be maintained, and one new railroad crossings would be required for the connector project for the road between LA 3127 and the Gramercy-Wallace Bridge. This crossing would require an overpass as would all new railroad crossings. Alternative 1 would maintain existing major waterway crossings, which include Bayou Lafourche and the Mississippi River.

2.5.2 Alternative 1A.

Alignment. The alignment of Alternative 1A is also denoted in yellow on all figures with alternatives. This alternative is actually an operational option of Alternative 1. Under this option, all of the improvements noted for Alternative 1 are proposed.

However, in addition to these construction improvements, the two-lane LA 308 facility from the junction with LA 3185 to Spur 70 would be operated as a two-lane northbound facility during hurricane evacuations. LA 1 would continue to operate in both (north and south) directions. Operation of LA 308 as a two-lane northbound facility would continue through the LA 70 spur onto the connection with LA 70 south of the Sunshine Bridge. With this operational change, southbound left turns would be eliminated, and signal delays would be greatly reduced, as well. It was envisioned that emergency personnel including State and Local Police would operate and enforce this one-way outbound operation. Like Alternative 1, Alternative 1A and the other alternatives would include a project to connect existing LA 3127 to the Gramercy-Wallace Bridge approach.

Intersections/Interchanges. Like Alternative 1, Alternative 1A would not involve any additional improvements other than the overlay and shoulder improvements on LA 3185 and LA 308, and Spur 70; however, operational changes at LA 308 intersections would be imposed and governed by emergency personnel during emergencies. Likewise, the Gramercy-Wallace Bridge connector project would require an additional intersection at its junction with LA 3127.

Railroad and Surface Water Crossings. Like Alternative 1, only one additional railroad overpass would be required for Alternative 1A (i.e., a new intersection on LA 3127 for the Gramercy Wallace Bridge connector project). No new waterway crossings would be required with Alternative 1A; however, the two primary existing waterway crossings would be maintained under this alternative.

2.5.3 Alternative 2

Alignment. The alignment of Alternative 2 is denoted in light blue on all figures with alternatives identified. Alternative 2 primarily utilizes existing alignment but contains some new location alignment. It begins to the south at the junction of Relocated US 90/LA 3052 and LA 24. LA 24 would continue to operate as a four-lane couplet system bordering Bayou Terrebonne through to its LA 3185 (Thibodaux Bypass) junction. From this point, LA 3185 would be widened to four lanes to its junction with LA 308. A new location section would be required between LA 308 and LA 20, spanning approximately 20,900 feet (4.0 mi). The LA 20 corridor would be widened from two to four lanes between its junction with the new location construction segment and LA 3127. East of this junction, LA 3127 would be widened from two to four lanes to the proposed new Gramercy-Wallace Bridge approach, which is proposed for all alternatives as a critical link improvement. LA 654 would also be widened from two to four lanes on the north side of the Gramercy-Wallace bridge though to the junction of LA 654 and US 61, located north of I-10. Largely utilizing uncontrolled access existing roadways, the entire alignment for Alternative 2 would remain uncontrolled access.

Intersections/Interchanges. Generally on existing alignment, Alternative 2 would only require additional intersections at either end of the new location construction segment between LA 308 and LA 20 and for the Gramercy-Wallace Bridge connector project (i.e, on LA 3127).

Railroad and Surface Water Crossings. Like the other alternatives, Alternative 2 would include the critical link project that connects LA 3127 with the Gramercy-Wallace Bridge approach, which requires the construction of one new railroad overpass. Another new railroad overpass would be required for the railroad crossing along the new location segment between LA 308 and LA 20. Additionally, five existing railroad crossings would be maintained, and five existing major waterway crossings would be maintained under this alternative.

2.5.4. Alternative 3

Alignment. The alignment of Alternative 3 is denoted in green on all figures with alternatives. Alternative 3 is very similar to Alternative 1; however, under Alternative 3, travel lanes would be added along LA 311 between Relocated US 90 and the Thibodaux Bypass (LA 3185), along LA 308, and between Spur 70 and LA 70, where necessary to widen these facilities from two to four lanes. This would create a continuous four-lane facility from Relocated US 90/LA 3052 to I-10 and US 61. No operational changes, as proposed under Alternative 1A, would be proposed under Alternative 3. As with the other alternatives, a connection between LA 3127 and the Gramercy-Wallace Bridge and improvements to LA 3127 and beyond the Bridge on LA 641 to US 61 would also be included. Utilizing uncontrolled access existing roadways, the entire alignment for Alternative 3 would remain uncontrolled access.

Intersections/Interchanges. Alternative 3 would make improvements to existing LA 311, LA 308, Spur 70 and LA 70. Therefore, no new intersections would be required for

this alternative except for the new intersection at the LA 3127/Gramercy-Wallace Bridge connector road.

Railroad and Surface Water Crossings. The number of railroad and waterway crossings would not change between Alternatives 1/1A and Alternative 3. Seven existing railroad crossings along the LA 311/LA 1/308 corridor would be maintained, and one new railroad overpass would be required for the connector project for the road between LA 3127 and the Gramercy-Wallace Bridge. Two existing major waterway crossings would also be maintained.

2.6 New Location Construction Alternatives

As described in Section 2.4, composite segments evolved into alternatives. Five new location construction alternatives were evaluated. Except for Alternative 4, all five alternatives lead north to LA 3127 through identified wetlands between the Lafourche and Mississippi ridges. Alternative 4 ties into US 70 and the Sunshine Bridge. A detailed description of each of the new location construction alternatives follows.

2.6.1. Alternative 4

Alignment. The alignment of Alternative 4 is denoted in orange on all figures with alternatives. Alternative 4 begins at Relocated US 90/LA 3052, extending north, northwest parallel and west of the Little Bayou Black ridge. This alternative would be on new location, located generally between the western wetlands interface and the agriculture and residential development along LA 311. A few small residential

subdivisions are located in close proximity to this corridor as is an unofficial waste site and the Thibodaux General Aviation airport, approximately 4,600 feet south of the Thibodaux Bypass Road. The current conceptual alignment for this alternative avoids the airport by passing through the northeastern edge of the bordering wetlands. At the airport, this new location alignment would take a westerly turn, paralleling the Thibodaux Bypass and eventually turning northward and intersecting with LA 1/LA 308 west of the existing intersection of LA 1/LA 308 and the Thibodaux Bypass (LA 3185). The alignment would continue west, northwest along the Lafourche Ridge in a corridor bordered to the northeast by wetlands and development along the LA 308 corridor to the southwest. The corridor would continue along its west, northwesterly alignment, generally paralleling LA 308 to its junction with Spur 70. Spur 70 and LA 70 would be widened where necessary to four lanes through the Sunshine Bridge to I-10. As noted with the other alternatives (both improvement and new location construction alternatives), a connection between LA 3127 and the Gramercy-Wallace Bridge and improvements along LA 3127 and extending between the bridge and US 61 would be provided with this alternative. New location construction would be all uncontrolled access.

Intersections/Interchanges. Because Alternative 4 would be largely new location construction, new intersections would be required at crossings of existing roadways. Based on the locations of major arterials in the study area, at least eight new intersections would be required. South of LA 1/LA 308, at-grade intersections would be required at the junctions with the following roadways: Relocated US 90, LA 20, LA 3107, and LA 1.

North of the proposed intersection with LA 1 would be an intersection with LA 308. West of this intersection, the alignment would take a northwesterly path that would require intersections at LA 304 and LA 1014 and the new roadway's terminus at its junction with Spur LA 70. The junction of the new Gramercy-Wallace Bridge connector road would also require a new intersection.

Railroad and Surface Water Crossings. The new alignment of Alternative 4 would require new crossings of three sets of railroad tracks, two of which are located south of the new alignment's proposed junction with LA 1/LA 308 and all of which would require construction of overpasses. The third crossing is located north of LA 308. A new railroad overpass would also be required for the LA 3127/Gramercy-Wallace Bridge connector road, which is included with all alternative proposals as a critical link project.

A new crossing of Bayou Lafourche, west of the existing LA 3185 crossing, would be required with the implementation of Alternative 4, as well as new crossings of other small canals and drainage swales.

2.6.2. Alternative 5

Alignment. The alignment of Alternative 5 is denoted in dark turquoise on all figures with alternatives. Alternative 5 begins near Raceland at Relocated US 90/LA 3052. Its alignment extends north, northwest along a straight path through the western edge of the Lac Des Allemands wetlands. The new location alignment would be largely controlled access and connect with LA 3127 at its proposed intersection with the Gramercy-Wallace

Bridge approach. Improvements beyond the bridge on LA 641 to I-10 would also be included in this alternative.

Intersections/Interchanges. Alternative 5 would be almost wholly on new location, with at-grade intersections required for its junctions with US 90, LA 307, LA 643 and LA 3127.

Railroad and Surface Water Crossings. The alignment of Alternative 5 also traverses two additional sets of railroad tracks located north of its junction with US 90, as well as the additional railroad crossing required for the LA 3127/Gramercy-Wallace Bridge connector project. Both of these railroad crossings would require overpasses. Alternative 5 would also require the crossing of Grand Bayou and Bayou Chevreuil, both located near Lac Des Allemands; however, the locations of the crossings are within an area assumed to be elevated for the purpose of avoiding wetland impacts. Therefore, additional structural costs for these crossing may not be required.

2.6.3. Alternative 6 and 6A

Alignment. The alignments of Alternative 6 and 6A are denoted in red on all figures with alternatives, with a separate, common segment denoted in purple. Alternatives 7 and 7A also share this segment along LA 3127 denoted in purple. Alternatives 6 and 6A are slight variations of the same general new location alignment. They begin at Relocated US 90 at the same location proposed for Alternative 4. Like Alternative 4, the alignment for Alternatives 6 and 6A would parallel the western edge of the Little Bayou Black

ridge. At the junction of this new location alignment and LA 308, Alternatives 6 and 6A would depart from Alternative 4's alignment and lead north. Alternative 6 would follow a more direct alignment to LA 3127, having a junction with LA 3127 approximately equidistant from the Sunshine Bridge and the proposed new Gramercy-Wallace Bridge approach. Alternative 6A would follow along a more westward path to LA 3127, intersecting LA 3127 closer to the Sunshine Bridge than to the proposed new Gramercy-Wallace Bridge approach. Both alternative options (Alternative 6 and 6A) would include improvements to LA 3127 between the Sunshine Bridge and the new Gramercy-Wallace Bridge, and between the Gramercy-Wallace Bridge to I-10. Controlled access sections of proposed Alternatives 6 and 6A would be limited to elevated sections within large wetland crossings.

Intersections/Interchanges. South of LA 1/LA 308, this new roadway would follow the same alignment as Alternative 4, which would require at-grade intersections at the junctions with the following roadways: Relocated US 90, LA 20, and LA 3107, and LA 1. North of the proposed intersection with LA 1 would be an intersection with LA 308, LA 304, and the new roadway's terminus at its junction with LA 3127. The junction of the new Gramercy-Wallace bridge connector road with LA 3122 would also require a new intersection.

Railroad and Surface Water Crossings. Like Alternative 4, Alternatives 6 and 6A would require new crossings of two sets of railroad tracks south of the proposed junction with LA 1/LA 308. North of LA 1, this alternative would require one new railroad

crossing north of Bayou Lafourche and one new railroad crossing for the LA 3127/Gramercy Wallace Bridge connector project. All new railroad crossings would require the construction of overpasses. Several other existing railroad crossings would be maintained for improvements to LA 70 and the LA 641. Alternative 6 and 6A's alignment would also require a new crossing of Bayou Lafourche at the LA 1/LA 308 junction and of Bayous Citanon and Chevreuil, located south of the new roadway's terminus at LA 3127. Other small canals and drainage swales would also be traversed.

2.6.4. Alternatives 7 and 7A

Alignment. The alignments of Alternative 7 and 7A are denoted in dark blue on all figures with alternatives, with a separate, common segment denoted in purple. Alternatives 6 and 6A also share this segment along LA 3127 denoted in purple. Alternatives 7 and 7A are also slight variations of the same general alignment; however, the southern terminus of these alternatives is located east of Bayou Terrebonne, approximately 25,000 ft (4.7 mi) east of the proposed terminus for Alternatives 6 and 6A. Alternatives 7 and 7A begin on Relocated US 90 on the eastern edge of the Bayou Blue Ridge. This new location alignment follows this ridge between the wetland interface located east of the alignment and residential land use adjacent to LA 316 west of the alignment, traversing mostly agricultural lands. The alignment would cross undeveloped land between Nicholls State University and residential land use to the east before crossing Bayou Lafourche and LA 1/LA 308. North of this junction, the new location alignment would extend northward along one of two alignments. The more direct alignment (Alternative 7) would follow the existing Laurel Valley Plantation Ridge as

much as possible to the west and north of Laurel Valley Plantation. North of the Laurel Valley Plantation, Alternative 7 would cross some wetlands south and north of the Choctaw community through to its proposed juncture with existing LA 20. From LA 20, the new location alignment of Alternative 7 would follow the same alignment as Alternative 2, along existing LA 20 to a location just south of LA 3127, where the alignment would be straightened and depart from existing LA 20. This new location alignment would then intersect with LA 3127, approximately 0.25 mile west of the existing intersection of LA 3127 and LA 20. Like Alternative 2, Alternative 7 would include improvement of LA 3127 between this new junction and the proposed, new approach to the Gramercy-Wallace Bridge. Likewise, Alternative 7 would include improvements to LA 641 north of the Gramercy-Wallace Bridge and widening of LA 3127 west to the junction with LA 70, near the Sunshine Bridge. Alternative 7A would follow the same alignment as Alternative 7 from Relocated US 90 through to its intersection with LA 1/LA 308. From this point, the alignment would take a west, northwesterly alignment to LA 3127, converging with Alternative 6's alignment south of its proposed junction with LA 20, between the communities of Choupic and Chackbay. North of this junction, the alignment would follow along the same alignment as Alternative 6 through to its intersection with LA 3127. Like Alternatives 6, 6A, and 7, Alternative 7A would include improvements to LA 3127, the Gramercy-Wallace Bridge connector, and LA 641 between the Gramercy-Wallace Bridge to I-10. Controlled access sections of proposed Alternatives 7 and 7A would be limited to elevated sections within wetland crossings.

Intersections/Interchanges. Alternatives 7 and 7A would be located on new alignment south of its junction with LA 1/LA 308. The only primary new at-grade intersections would be located at the junctions of US 90 and LA 1; however, there are a few local roads that would also be bisected. North of LA 1, Alternative 7 would require intersections at LA 308, LA 307, LA 20, and at the new road's terminus at LA 3127. Alternative 7A, however, would take a more northwesterly tract along the proposed corridor of Alternative 6. This alignment would require intersections at LA 308, LA 20, LA 304, and LA 3127 (the new roadway's northern terminus). Like with the other alternatives, Alternatives 7 and 7A would also require a new intersection at the junction of LA 3127 and the Gramercy-Wallace Bridge connector road.

Railroad and Surface Water Crossings. The alignments of Alternatives 7 and 7A would require only one new railroad overpass south of Bayou Lafourche and the one new railroad overpass associated with the Gramercy-Wallace Bridge connector road. New waterway crossings would be required for both alternatives. New, waterway crossings for Alternative 7 would include from south to north the following waterways: Bayou Blue, Bayou Cutoff, Bayou Lafourche, a major canal that connects with Lake Bouef, and Grand Bayou. A crossing of Bayou Chevreuil would be maintained for the improvement of the section of LA 20 between the new location construction sections of Alternative 7. New, waterway crossings for Alternative 7A would include from south to north the following waterways: Bayou Blue, Bayou Cutoff, Bayou Lafourche, Bayou Citanon, and Bayou Chevreuil.

2.7 Critical Link Projects

The traffic analysis conducted for this project resulted in the identification of several critical links to the evacuation network. These critical links are discussed in detail in the Traffic Analysis conducted for this project summarized in Section 3.0 of this document. Two of these links are already listed projects on the State Transportation Improvement Program: 1) improvement of LA 70 between the Sunshine Bridge and I-10, and 2) new construction of a connector road between LA 3127 and the Gramercy-Wallace Bridge. Improvement of LA 70 is underway; however, the connector road between LA 3127 and the Gramercy-Wallace Bridge is currently unfunded. It was assumed that the provision of this connector road would be included in all build alternatives because of the relative importance of this improvement to hurricane evacuation.

Alignment. This connector project would span from LA 3127 and connect with LA 18 and the Gramercy-Wallace Bridge approach.

Intersections/Interchanges. The new connector road between LA 3127 and the Gramercy-Wallace Bridge would tie into an existing interchange at LA 18 for the approach to the Bridge. No other intersections or interchanges would be required for this project.

Railroad and Surface Water Crossings. The LA 3127/Gramercy Wallace Bridge connector road would traverse one railroad line in route to the approach to the Bridge,

requiring construction of an overpass. However, no substantial waterways would be crossed by this project.

2.8 Cost Analysis

2.8.1. Construction Costs

Improvements identified for each alternative are either 1) improvements to the existing roadway network, or 2) roadway construction on new locations. Roadway construction on new locations can be separated into 1) at-grade or 2) elevated roadway construction.

Each alternative was broken into segments that fall into one of the following four categories:

1. Improvements to existing roadway through cold milling, overlaying, and the addition of shoulders;
2. Improvements to existing roadway by adding two travel lanes;
3. Construction of four lanes of elevated roadway on new locations;
4. Construction of four lanes of at-grade roadway on new locations.

Where possible, the existing roadway network was assumed to be utilized, improving upon current conditions for the TSM alternatives (i.e., Alternatives 1 and 1A). Alternatives that call for additional capacity acquire the increase through the addition of two new travel lanes. In an effort to minimize the impacts to the wetlands, it was assumed that an elevated roadway section would be used in new locations traversing

substantial wetland areas. Elsewhere, at-grade sections were assumed to be preferred for new location construction.

Although the fully-constructed alternatives were evaluated in the impact and cost analysis for this project, costs for four-lane facilities were also segmented into costs for two two-lane facilities for incremental phasing of all alternatives considered as discussed in Section 5.0 of this document. Costs for elevated, at-grade, railroad, and substantial waterway crossings were estimated for two and four-lane crossings to provide for this greater planning flexibility.

Assumptions for Existing Roadway Widening

Improvements to the existing roadway through cold milling, overlaying and the addition of shoulders would require:

1. Removal of a minimum of 2 inches of asphaltic concrete material
2. 2 inches of an asphaltic concrete wearing course (for overlaying purposes)
3. A minimum of 6 inches of a base course for new shoulders
4. 2 ½ inches of asphaltic concrete binder course for new shoulders
5. 1 ½ inches of asphaltic concrete wearing course for new shoulders
6. Additional striping

It was estimated that these improvements would cost approximately $242,800 per mile.

The addition of two new travel lanes to an existing roadway necessitates that any existing shoulder is to be removed and the following be put in place for each travel lane:

1. 8-12 inches of a sub-base material
2. 6 inches of an aggregate base course
3. 3 ½ inches of an asphaltic concrete binder course
4. 2 inches of an asphaltic concrete wearing course

Construction of new shoulders, as previously described in the milling and overlay section, is required. Per mile, the actions needed to construct two additional travel lanes would result in a cost of approximately $967,700. This cost assumed an open ditch drainage system.

Assumptions for Construction On New Locations

Construction of a new four-lane roadway is required wherever an alternative calls for a new alignment location. There are two possible types of construction for new location of roadway: 1) construction of at-grade roadway, and 2) elevated roadway.

At-grade roadway construction in new locations is similar to an option discussed earlier: additions of two travel lanes. New construction of an at-grade roadway differs from the earlier option in the number of lanes that are built. The general fabrication of the roadway is identical, except for the width of construction. Because the number of lanes increases, the overall width for construction is larger. This additional width is reflected in the per

mile cost, which is approximately $1,935,400; twice that of the additional travel lanes option. Figure 2.4 displays the typical improved 2-lane and 4-lane roadway assumed for this study.

The determination of the construction costs for the elevated section of roadway were based on the following assumptions. The width is based on two 12-foot lanes with a 10-foot outside and a 6-foot inside shoulder. Two separate 2-lane structures would comprise the four-lane facility. Span lengths for AASHTO P.P.C. Type IV girders were used. Circular columns on pile-supported footings using pre-cast concrete piles were also assumed to be used. At $17,500,000 per mile, the four-lane elevated sections (two two-lane sections) were the most expensive segments on new location construction. Figure 2.5 displays the typical section and elevation of the new location elevated 4-lane roadway assumed for this study.

Assumptions for Railroad and Waterway Crossings

Crossings of railroads and substantial surface waters will require bridged structures. For the alternative cost estimates, a generic crossing cost was developed for both a railroad and a surface water crossing. The railroad crossing was assumed to require a horizontal clearance of 50 feet and a vertical clearance of 23.5 feet. The surface water crossing was assumed to be 30 feet wide and require a vertical clearance of 16.5 feet. A design speed of 70 mph was used for the structures, and the structures were assumed to be two lanes wide, requiring two separated structures for a four-lane section. The structure depth was assumed to be 5.5 feet. The allowable embankment height of 18 feet and an embankment

slope of 3:1 was likewise used in the estimate, and costs calculated for at-grade roadway and elevated roadway were assumed for the section roadway. The resulting costs for two-lane railroad crossings and two-lane surface water crossings were estimated to be approximately $3,224,000 and $300,000, respectively. These costs were applied independently to segments, and aggregated into alternatives to develop total construction costs of these crossings, by alternative. Figure 2.6 displays the typical sections and elevations of the railroad and waterway crossings assumed in this study.

Construction Cost Calculations

Individual alternative alignments were divided into a series of smaller segments based upon the proposed action to be taken. These smaller segment lengths were used to obtain the individual segment improvement costs by applying corresponding improvement costs, per mile. Base construction costs were then increased by 30 percent to account for engineering services, administration costs, and contingencies. These adjusted construction costs were then summed for each alternative, resulting in a total estimated cost of construction for each alternative as displayed in Table 2.2.

Figure 2.4 Typical Sections at Grade Improvements

See filename FIG2_4.PDF

This figure displays the cross-section of a typical section of the proposed roadway along at-grade (i.e., ground-level) sections. It shows width of the median, width of the travel lanes, width of the right-of-way, and other data.

Figure 2.5 Typical Sections Elevated Roadway

See filename FIG2_5.PDF

This figure displays the cross-section and profile (i.e., side) view of the proposed roadway along elevated sections. It shows width of the median, width of the travel lanes, width of the right-of-way, and other data.

Figure 2.6 Typical Sections Railroad & Waterway Crossings

See filename FIG2_6.PDF

This figure displays the cross-section and profile (side) views of a typical railroad overpass and waterway crossing that would be incorporated into the design of any of the alternatives. It shows width of the median, width of the travel lanes, width of the right-of-way, and other data.

Table 2.2. Construction Mileage and Costs Matrix, by Alternative

Alternative	Distance (miles)			Construction Costs ($millions)		
	New Location Elevated Construction	New Location At-Grade Construction	Improvements to Existing Alignment (Widening or adding shoulders)	Base	Adjustments	Total Estimate
1	0.0	2.6	70.5	54.4	16.3	70.7
1A	0.0	2.6	70.5	54.4	16.3	70.7
2	0.0	2.6	38.5	81.7	24.6	106.3
3	0.0	2.6	74.2	82.9	24.9	107.8
4	2.9	28.8	22.1	175.4	52.6	228.0
5	16.7	6.1	6.7	349.2	104.8	454.0
6	10.3	9.7	43.4	294.1	88.2	382.3
6A	11.5	12.4	40.2	302.5	90.8	393.3
7	4.1	9.9	51.4	181.1	54.3	235.4
7A	7.4	2.8	54.0	231.6	69.5	301.1

Note: All costs are rounded to the nearest $100,000. Base construction costs refer to unadjusted construction costs of full alternatives as envisioned. Adjustments refer to costs to account for engineering design services and contingencies.

Sources: URS Greiner Woodward Clyde. Quantities calculations per embankment mile, elevated section mile, and railroad and waterway crossings. 1999.

2.8.2. Right-Of-Way Costs

Each alternative requires that some right-of-way be acquired. Right-of-way required will differ along the many segments of each of the alternatives. Because the great expanse of the project and the many alternatives that are under consideration, detailed right-of-way estimates, by alternative, was imprudent and impractical. Rather, a generalized approach was used to estimate right-of-way costs. Unit cost assumptions for different land uses were obtained from the LDOTD Real Estate office. These assumptions are listed below in Table 2.3.

Table 2.3. Per Unit Cost Assumptions for Right-of-Way Estimates

Land Use/Property Type	Unit Cost
Developed Urban	$1 / sf
Cropland/Agriculture	$1,500 / ac
Undeveloped Upland (Fallow Ag. Land)	$800 / ac
Undeveloped Wetland	$400 / ac
Commercial	$3 / sf
Industrial River Front	$15,000 / ac
Industrial Backland	$6,000 / ac
Campsites	$2,000 / ac

Note: "sf" refers to square-foot; "ac" refers to acre.

Source: LDOTD, Property Valuation Factors. Received from Real Estate Office in a letter dated January 11, 1999.

A satellite image was overlain with the preliminary alternative alignments for the project. Linear distances, by segment, were calculated for contiguous land uses, and right-of-way requirements were estimated for section types. Right-of-way widths ranged from 115 feet in areas where elevated sections would be used through wetlands or within developed urban areas to 250 feet in rural areas where few if any constraints are present. In general, 115-foot and 150-foot right-of-way widths were used for this analysis. The difference between existing and proposed right-of-way widths was calculated, by segment and multiplied by the linear distance of the segment. Per unit values were then applied to determine the estimated costs of right-of-way on the subject segments. Segments' costs were then aggregated for alternatives to develop total estimated alternative right-of-way costs. These total alternative right-of-way costs were then adjusted to incorporate the administrative costs associated with administration, acquisition, relocation, and utilities work. A multiplier of 1.75 was used for this purpose as suggested by the LDOTD Real Estate Office. Resulting estimates are displayed in Table 2.4.

Table 2.4. Total Estimated Right-of-Way Land, Relocation, Administration, and Utilities Relocation Costs

Alternative	Base Right-of-Way Costs ($millions)	Adjustment to Base Right-of-Way Costs to Account for Administration, Utilities Relocation, and others ($millions)	Total Right-of-Way Cost Estimate ($millions)
1	0.08	0.06	0.1
1A	0.08	0.06	0.1
2	7.60	5.70	13.3
3	6.60	5.00	11.6
4	3.80	2.90	6.7
5	0.50	0.30	0.8
6	2.70	2.00	4.7
6A	2.70	2.10	4.8
7	4.40	3.40	7.8
7A	4.00	2.90	6.9

Note: All costs are rounded to the nearest $100,000 except for Alternatives 1 and 1A. Adjustment factor of 1.75 was provided by the LDOTD Real Estate Office and was used as a multiplier to base right-of-way costs. This adjustment is intended to account for the additional residential and business relocation expenses, administration, utilities relocation, and other costs of right-of-way acquisition.

Source: LDOTD, Property Valuation Factors. Received from Real Estate Office in a letter dated January 11, 1999; Braud, DeWitt H. Jr. 1997. Satellite View of Louisiana from the Merge of Landsat Thematic Mapper and Spot Imagery. Louisiana Department of Environmental Quality and the Department of Natural Resources: Baton Rouge, La. In association with the U.S. Geological Survey's National Wetlands Research Center in Lafayette, LA; URS Greiner Woodward Clyde, 1999.

2.8.3. Other Costs

Highway construction costs include many cost items, of which some are difficult to estimate. Standard cost factors such as construction materials, labor, administrative, design services and property acquisition are regularly estimated and can therefore be accurately estimated. Other costs factors are either difficult to foresee and/or estimate. Of the reasonably foreseeable costs that may result from the construction or improvement of a hurricane evacuation route are the costs associated with the mitigation of wetland impacts. While heavily dependent upon the functions and values of impacted wetlands and the type of mitigation proposed for these impacts, a cost estimate for wetland impacts, by alternative, was prepared for this project. Inquiries to the U.S. Army Corps of Engineers (USACE) suggest that the impacts to productive cypress/tupelo gum

swamps would result in mitigation ratios between 2 and 3 to one; that is, the USACE would likely require between 2 and 3 acres of wetlands be provided for each acre that is adversely affected (taken for use or disturbed) by the project. Replacement of wetlands can be accomplished by the following methods in decreasing preference of the USACE and EPA: restoration, creation, enhancement, and preservation. Restoration, creation, and enhancement plans and costs are site-specific, depending upon the functions of the existing hydrological and habitat conditions of the land. For the wetland mitigation cost estimates prepared for this study, it was assumed that wetland mitigation would be provided solely through preservation at prevalent wetland banking rates. Wetland banking rates in the south Louisiana area range between $4,000 and $5,000 an acre. Per acre wetland banking costs were applied to the estimated number of wetland mitigation acres that would be impacted required by the USACE (i.e., impacted acreage x 3), by alternative (See section 4.3.2 for discussion of wetland impacts.). Resulting estimates are displayed in Table 2.5. No other mitigation or other costs were estimated for the alternatives considered in this study.

Table 2.5. Total Estimated Wetland Mitigation Preservation Costs

Alternative	Cost ($millions)
1	0.7
1A	0.7
2	2.6
3	1.9
4	2.5
5	2.8
6	5.4
6A	5.6
7	5.2
7A	5.1

Note: All costs are rounded to the nearest $100,000. Wetland impact costs based solely on the costs associated with 100 percent preservation mitigation. An acceptable wetland mitigation plan for any of the proposed alternative corridors would likely include restoration, enhancement, and/or creation components. However, estimation of these costs depends upon site characteristics, impossible to predict at this early planning stage.

Sources: USACE, Discussion with Environmental Specialist regarding wetland banking per acre costs and replacement ratios for productive cypress-tupelo swamp impacts; Braud, DeWitt H., Jr. 1997. Satellite View of Louisiana from the Merge of Landsat Thematic Mapper and Spot Imagery. Louisiana Department of Environmental Quality and the Department of Natural Resources: Baton Rouge, La. In association with the U.S. Geological Survey's National Wetlands Research Center in Lafayette, LA; URS Greiner Woodward Clyde, 1999.

2.8.4. Total Alternative Costs

Total costs, by alternative, were developed by aggregating component costs (i.e., construction, right-of-way, and wetlands mitigation [i.e., wetland preservation banking cost estimates]), for each alternative considered. Table 2.6 below summarizes the costs of each alternative, by component, providing an estimated cost comparison matrix.

Table 2.6. Total Estimated Costs Comparison Matrix

Alternative	Construction ($millions)	Right-of-Way ($millions)	Other ($millions)	Total ($millions)
1	70.7	0.1	0.7	71.5
1A	70.7	0.1	0.7	71.5
2	106.3	13.3	2.6	122.2
3	107.8	11.6	1.9	121.3
4	228.0	6.7	2.5	237.2
5	454.0	0.8	2.8	457.6
6	382.3	4.7	5.4	392.4
6A	393.3	4.8	5.6	403.7
7	235.4	7.8	5.2	248.4
7A	301.1	6.9	5.1	313.1

Note: All costs are rounded to the nearest $100,000. Alternative 1A would also include costs associated with the operation of LA 308 as a controlled-access facility during hurricane evacuation events. These operational costs were not estimated.

Sources: Specific sources noted in source tables 2.2 through 2.5 of this document; URS Greiner Woodward Clyde, 1999.

3.0 TRANSPORTATION ANALYSIS

After preliminary alternatives were developed, these alternatives were evaluated with respect to how they would benefit the network in a hurricane evacuation. This analysis was conducted with the use of a customized TRANPLAN transportation demand model. This transportation analysis utilized a long range transportation model for the evaluation of potential corridors under hurricane evacuation conditions. As part of this effort, travel patterns were analyzed to develop a modeling methodology that allowed the evaluation of the corridor alternatives based on their ability to 1) move traffic out of the service area, 2) balance the traffic between critical links, and 3) utilize available capacity. The full transportation analysis report (URS Greiner Woodward Clyde 1999) is incorporated by reference into this document. Excerpts and data summaries are reproduced in this section.

The TRANPLAN model was developed using available GIS data, previous hurricane evacuation analyses, and behavioral studies. Figure 3.1 displays the TRANPLAN model area and expanded project study area. As a precursor to running the model, assumptions were made, socioeconomic data were analyzed, and a simulated road network was created. Given the various assumptions and input data, the number of evacuating vehicles was determined. These vehicles were distributed to various evacuation zones and then assigned to the roadway network. Using the model, each of the various corridor alternatives was tested for both the existing year (1997) and on a long range basis (2020). The existing plus committed network based on LDOTD's proposed letting

Figure 3.1 Transportation Model Study Area

See filename FIG3_1.PDF

This figure displays the area within Louisiana that was incorporated into the transportation demand model conducted for the project to determine the efficiency of hurricane evacuation routes. It also shows the major surface transportation facilities that were used in the model.

schedule was incorporated into the 2020 network; however, only funded projects were included. As a measure of effectiveness, volume to capacity (V/C) ratios were used to identify where critical links were located and to determine how the various alternatives affected the roadway network. Tables 3.1 and 3.2 provide comparisons of V/C ratios in 1997 and 2020, respectively, under the different alternative scenarios.

Table 3.1. 1997 Alternative Volume to Capacity Ratio Comparison Matrix

Alternative	Sunshine Bridge	Gramercy -Wallace Bridge*	US 90 West	Sum	Maximum	Standard Deviation	Subjective Ranking**
Base Capacity	15.62	21.91	16.59	54.12	21.91	2.77	
2	10.17	19.12	18.68	47.97	19.12	4.12	1
3	19.10	19.34	16.12	54.56	19.34	1.46	2
1A	16.23	23.25	15.19	54.67	23.25	3.58	3
1	15.38	25.87	15.81	57.06	25.87	4.85	4
New Arterials							
6A	16.54	13.36	18.03	47.93	18.03	1.95	1
6	14.84	16.56	17.90	49.30	17.90	1.25	2
7A	12.88	18.25	17.09	48.22	18.25	2.31	3
4	20.47	15.13	16.92	52.52	20.47	2.22	4
7	10.93	20.99	17.53	49.45	20.99	4.17	5
New Freeways							
6A-F	16.79	15.18	19.68	51.65	19.68	1.86	1
6-F	14.25	15.52	19.31	49.08	19.31	2.15	2
7A-F	11.71	15.41	19.69	46.81	19.69	3.26	3
4-F	20.09	15.11	16.59	51.79	20.09	2.09	4
5	9.53	18.32	20.88	48.73	20.88	4.86	5
7-F	9.76	23.04	17.76	50.56	23.04	5.46	6

* Indicates V/C ratio of bridge or approaches leading to the bridge, whichever is greater. The critical links are as follows:
LA 20 south of LA 3127 - Base and Alts. 1, 1A, 3, and 4.
Gramercy-Wallace Bridge - Alts. 2,5,6,6A,7 and 7A

** The ranking for each group was based on an evaluation and comparison of the sum, maximum, and standard deviation of the V/C ratios for each alternative.

Table 3.2. 2020 Alternative Volume to Capacity Ratio Comparison Matrix

Alternative	Sunshine Bridge	Gramercy-Wallace Bridge*	US 90 West	Sum	Maximum	Standard Deviation	Subjective Ranking**
Base Capacity	17.77	25.13	18.14	61.04	25.13	3.39	
2	11.68	21.51	18.35	51.54	21.51	4.10	1
3	19.68	21.74	16.28	57.70	21.74	2.25	2
1A	19.46	25.15	17.40	62.01	25.15	3.28	3
1	16.38	29.31	16.80	62.49	29.31	6.00	4
New Arterials							
7A	16.81	14.93	18.38	50.12	18.38	1.41	1
6A	19.99	14.36	18.05	52.40	19.99	2.34	2
6	14.73	20.21	20.25	55.19	20.25	2.59	3
4	22.12	18.36	16.52	57.00	22.12	2.33	4
7	13.16	22.83	18.73	54.72	22.83	3.96	5
New Freeways							
6-F	15.94	19.92	19.69	55.55	19.92	1.82	1
5	10.36	19.84	20.71	50.91	20.71	4.69	2
7A-F	16.29	18.60	21.90	56.79	21.90	2.30	3
6A-F	20.62	15.27	21.27	57.16	21.27	2.69	4
4-F	24.05	17.78	16.87	58.70	24.05	3.19	5
7-F	11.97	24.25	20.34	56.56	24.25	5.12	6

* Indicates V/C ratio of bridge or approaches leading to the bridge, whichever is greater. The critical links are as follows:
LA 20 south of LA 3127 - Base and Alts. 1, 1A, 3, 4, and 7
Gramercy-Wallace Bridge - Alts. 2, 5, 6 ,6A, and 7A

** The ranking for each group was based on an evaluation and comparison of the sum, maximum, and standard deviation of the V/C ratios for each alternative.

This analysis was not intended to provide the definitive answer which alternative is best. Rather, the intent of the study was to evaluate the transportation issues so that they can be considered in conjunction with environmental, development, costs, and other considerations. The analysis resulted in the following conclusions and recommendations:

The evacuation time is controlled by the critical links. The critical links were locations where the highest V/C ratios exist and served as the control points for any vehicle desiring to exit the study area. The critical links were identified as the Sunshine

Bridge, Gramercy-Wallace Bridge (or approaches to the bridge such as LA 20 south of LA 3127 and River Road), and US 90 West of Morgan City.

A connection to the Gramercy-Wallace Bridge is needed. The Gramercy-Wallace Bridge currently is a four-lane bridge accessed by River Road which is a circuitous two-lane road with a capacity much lower than that of the bridge. If this bridge were to be used as an evacuation route, there must first be adequate access to the bridge. A connection between LA 3127 and the bridge would provide the necessary access.

The alternatives that best meet the hurricane evacuation purpose and need are those that split traffic evenly between critical links. Because the critical links control the amount of time it takes to evacuate the area, the best alternatives are those that are able to provide a balance between the critical links so that the overall time to clear the area is reduced. The V/C ratio analysis on the critical links indicates that Alternatives 7A, 6, and 6A provide the best balance between critical links over and above the base condition, as well as any other alternatives. Further, these alternatives were found to provide a better balance between critical links if constructed as arterials rather than as freeways.

The use of US 90 to the east of Raceland would adversely affect US 90 west of Morgan City. One of the original assumptions of this analysis is that US 90 from LA 307 to Des Allemands becomes inundated during the event of a hurricane and is, therefore, not an option as a hurricane evacuation route although it is designated as such. An analysis was performed to determine what would happen if this facility were

improved. Results indicate that the facility would attract westbound trips from New Orleans through to US 90 West towards Lafayette in addition to the eastbound evacuating traffic from the Thibodaux-Houma area. The result is that US 90 west of Morgan City would become even more congested and would need improvement in order to accommodate the additional westbound traffic.

Construction of partial alternatives (i.e., Interim Alternative Concepts as defined and proposed in Section 5.0 of this report) may be a lower-cost feasible option to the fully-envisioned alternatives. TRANPLAN model runs were completed, simulating only a portion of the full alternatives. Two-lane sections were assumed for new location construction between Relocated US 90 and LA 308, between LA 308 and LA 3127, and a four-lane road was assumed for the LA 3127 to Gramercy-Wallace Bridge connector road. Two-lane sections between Relocated US 90 and the Gramercy-Wallace Bridge connector road were modeled as northbound only, reversible facilities. No other improvements were modeled. Preliminary V/C calculations suggest that some benefits can be captured with the Interim Alternative Concepts; however, detailed analysis of these benefits, phasing and costs need to be conducted.

4.0 ALTERNATIVE CORRIDOR CONSTRAINTS

Alignment constraints were developed through the use of GIS data layers collected from various sources. Data layers that were not available in a GIS format were obtained in their original format and then processed to become GIS compatible. Once all data layers were in a GIS-compatible format, they were then applied to the expanded study area. In order to provide realistic planning projections of alignment effects, unique 1,000-foot corridors around each proposed alternative alignment were created in the GIS as part of the alternative development process. Queries were then made on the newly created 1,000-foot corridors to assess how each proposed alignment would impact an individual data layer. Corridor widths were reduced for wetland impact estimates and other effects in order to provide more accurate estimates of the probable magnitude of final alternative alignments. Sections 4.1 through 4.3 provide discussions of the existing conditions within the study area and the results of these effect analyses.

4.1 Socioeconomic Environment

4.1.1. Population and Development

Much of the study area is comprised of rural residential and agricultural development; however, several more densely populated areas are located within the study area. Figure 4.1 displays 1990 population density from the U.S. Bureau of the Census. Areas of higher population density correlate to communities displayed in the satellite image of the study area in Figure 2.3. The most densely developed region in the area is the City of Thibodaux.

Figure 4.1 1990 Population Density

See filename FIG4_1.PDF

This figure displays the density of persons per square mile in the study area, by US Census block group, in relation to the preliminary alternative corridors.

Other more densely populated areas are located on LA 643 south of LA 3127 and along the existing ridges lined by LA 1/LA 308, LA 20, LA 24, and LA 311.

Based on right-of-way land use assessments, land use acreage by type was estimated and is displayed in Table 4.1.

Table 4.1. Total Estimated Land Use within Alternative Corridor Right-of-Ways

Alternative	Developed Land (Acres)	Agricultural Use (Acres)	Undeveloped Upland (Acres)	Undeveloped Wetland (Acres)
1	0	210	0	50
1A	0	210	0	50
2	280	390	15	170
3	480	515	0	125
4	65	985	15	195
5	5	250	0	290
6	50	750	15	435
6A	50	725	15	450
7	85	920	10	375
7A	70	945	0	380

Notes: Estimated Acreage based on minimum right-of-way requirements (i.e, between 115 and 150 feet in most cases, and up to 250 feet in rural areas that do not traverse substantial tracts of wetlands. Land uses were estimated based on inspection of a satellite image of the affected area. Developed urban and industrial land uses were aggregated into the *Developed* acreage category, and wetlands were aggregated with camp sites to account for the fact that all possible camp site areas are located in wetlands. Acreages are rounded to the nearest 5 acres. Wetlands acreage in this table refers to the acreage of wetlands underlain by the existing right-of-way and not the necessarily equal to the amount of wetlands that would be impacted by the alternative corridors. Estimated wetland impacts are discussed in Section 4.3 of this report.

Sources: LDOTD, Categories of properties provided by the Real Estate Office. 1998; URS Greiner Woodward Clyde, 1999.

All alternative alignment corridors bypass the most densely developed Census blocks of Thibodaux; however, several of the alternatives (i.e., Alternatives 1, 1A, and 3) are located on the developed existing corridor of LA 1/LA 308. Although not apparent in Figure 4.1, new right-of-way acquisition along this corridor would displace the most residences and businesses of any alternative corridor. Because Alternatives 1 and 1A do not require new right-of-way acquisition along this corridor, these alternatives would not

impose the same social impacts as Alternative 3, which would require additional right-of-way along LA 308 to accommodate a four-lane roadway section.

All new location construction corridors (Alternatives 4, 6, 6A, 7, and 7A) would displace fewer residences and businesses than any of the alternatives that would require widening of the existing alignment (i.e., Alternatives 2, and 3).

4.1.2 . Public Sites and Services

Public sites were identified from U.S. Geological Survey topographic maps and provided in digital form on a GIS layer. Sites of consideration for alignment placement are denoted in the legend of Figure 4.2. Sites include public lands such as schools, parks and other parcels, as well as other noted public sites such as hospitals, churches, cemeteries, and transportation facilities. Oil fields are also noted on this figure.

Identified improvement construction alternatives that would require additional right-of-way would have a greater potential impact to noted sites than alternatives that would not require additional right-of-way along existing roads (e.g., Alternative 1 and 1A along LA 1/LA 308). Among the improvement alternatives (Alternatives 1, 1A, 2, and 3), Alternative 3, which would require additional right-of-way to accommodate a four-lane section on LA 308, would have the greatest potential to affect public sites and services. New location alternatives (e.g, Alternatives 4, 6, 6A, 7, and 7A) will largely avoid these sites of concern. Table 4.2 displays the numbers of potentially affected public sites and structures of concern for each alternative corridor.

Figure 4.2 Public Institutional and other Sites of Consideration

See filename FIG4_2.PDF

This figure displays the locations within the study area of major roadways, airports, schools, churches, cemeteries, substantial buildings, hospitals, oilfields, parks, dams, and railroads, in relation to the preliminary alternative corridors.

Table 4.2. Total Estimated Public Facilities and Other Sites of Consideration within Alternative Corridors

Alternative	Industrial Facilities	Schools	Oil Fields	Churches	Cemeteries	Communication Towers
1	13	4	1	6	2	1
1A	13	4	1	6	2	1
2	5	1	1	1	1	1
3	11	3	0	0	0	0
4	4	0	0	0	0	0
5	0	0	1	0	0	0
6	4	0	0	0	0	0
6A	4	0	0	0	0	0
7	6	0	0	0	0	0
7A	6	0	0	0	0	0

Notes: The numbers of facilities and sites of concern by alternative was determined from GIS queries that aggregated the number of like sites within each alternative corridor. For planning purposes, corridor width was assumed to be 1,000-feet wide; however, based on estimates, the actual required right-of-way will range between 115 feet in areas where wetlands or development is a concern to approximately 250 feet in rural areas where there are no alignment constraints.

Sources: U.S. Geological Survey. GNIS GIS data layer based upon topographic maps. Various dates of map sources. Obtained 1997; URS Greiner Woodward Clyde, 1999.

4.1.3. Cultural Resources

A preliminary records review was made of recorded archaeological sites and historic standing structures on file with the Louisiana Department of Culture, Recreation, and Tourism. National Register listings were also reviewed. No reconnaissance to identify and record new or verify existing sites was completed for this study. A total of 4,380 historic standing structures and 180 archaeological sites have been recorded within the expanded study area. Nearly all of the structures and archeological sites are located adjacent to the major waterways in the study area, i.e., the Mississippi River, Bayou Lafourche, and Bayou Terrebonne. The areas adjacent to these waterways have proven attractive as habitation sites for both the Native American and European settlers of the area. These water courses provided a means of transportation and access to rich agriculture land and abundant floral and faunal resources. In contrast, most of the central part of the study area is comprised of uninhabitable wetlands. Previously recorded

historic standing structures and historic archaeological sites within the study area are clustered along waterways and in the small river towns.

Based on this archival review, there are 53 sites listed in the National Register located within the expanded study area. St. James, Ascension, and Lafourche parishes have the largest number of sites listed in the National Register. Most of the recorded historic structures in the study area (i.e., structures older than 50 year of age), however, have not had their eligibility status evaluated under the National Registrar of Historic Places Criteria for evaluation (36 CFR 60.4 [a-d]).

Figure 4.3 displays the locations of historic standing structures that are listed in the National Register or are potentially eligible for listing but which have not been evaluated under the National Registrar of Historic Places Criteria for evaluation (36 CFR 60.4 [a-d]). The alternative corridors that encompass the greatest number of listed standing structures and those potentially eligible for listing are the corridors located on existing roadways, where development has been historically located. These alternatives include Alternatives 1, 1A, and 3. Table 4.3 summarizes the number of listed and potentially eligible standing structures, by alternative.

Figure 4.3 Structures Listed or Potentially Eligible for National Register

See filename FIG4_3.PDF

This figure displays the locations within the study area of standing structures listed in or potentially eligible for listing in the National Register of Historic Places. However, because of site-security reasons, this figure does not include archeological sites that are listed or are potentially eligible for listing in the National Register of Historic Places. All sites are presented in relation to the preliminary alternative corridors.

For site security reasons, locations of archaeological sites that are listed in the National Register or are potentially eligible for listing but which have not been evaluated, are not displayed on Figure 4.3. Table 4.3, however, also summarizes the numbers archaeological sites located within each alternative corridor, by type (i.e., listed or potentially eligible for listing in the National Register).

Like standing structures, the alternative corridors that encompass the greatest number of listed archaeological sties and those potentially eligible for listing are the corridors located on existing roadways, where development has been historically located. However, there are archaeology sites located within each alternative corridor, unlike standing structures. Because of the absence of a graphic for this effect analysis, the following discussion is provided.

Table 4.3. Total Estimated Cultural Resources Sites Within Alternative Corridors

Alternative	Sites Listed in the National Register		Sites for which National Register Eligibility Status is Unknown	
	Standing Structures	Archaeological Sties	Standing Structures	Archaeological Sites
1	11	6	174	20
1A	11	6	174	20
2	1	5	13	1
3	3	6	163	12
4	0	0	2	5
5	0	3	11	0
6	0	3	12	5
6A	0	3	12	5
7	0	6	14	6
7A	0	8	12	6

Notes: Data based solely on archival research. No reconnaissance surveys completed specifically for this project. Numbers reflect the total number of sites, by type, that are located within the 1,000-foot alternative corridor.

Sources: Louisiana Department of Culture, Recreation, and Tourism as cited by R. Christopher Goodwin's draft report (September 1998).

The corridor for the Gramercy-Wallace Bridge connector project includes several archaeological sites that are potentially eligible for listing located directly along the centerline of the corridor. One listed archaeological site is located east and within close proximity to this project's corridor. These sites must be considered for all alternatives because this project is a critical link project, which is included in each alternative considered.

Alternatives 1, 1A and 3 use the same corridor, except for the southern connection to Relocated US 90. Two listed sites are located west of LA 1, and two are located east of LA 308. Because no additional right-of-way would be required along LA 1, no effects to LA 1 sites are anticipated; however, the need for additional widening on LA 308 with Alternative 3, suggests that these sites may be affected by Alternative 3. One listed and several potentially eligible archaeology sites included in the number encompassed by the corridor for Alternative 1 and 1A are located along LA 24, where no improvements are proposed. Several other sites (one listed and several other potentially eligible sites) are located along the western side of LA 311, which would likely limit widening only to areas east in these locations.

The new location corridors for Alternative 6 and 6A do not contain any listed or recorded potentially eligible archaeology sites; however, the new location corridors for Alternative 7 and 7A include several listed archaeological sites associated with the Laurel Valley Plantation. However, recorded boundaries provide up to a 1,000-foot clearance between

sites. Other recorded potentially eligible archaeological site boundaries along the Alternative 7 and 7A corridors appear to be avoidable, as well.

4.2 Physical Environment

4.2.1. Prime and Unique Farmland Soils

The Farmland Protection Policy Act (7 CFR Part 658) establishes criteria for identifying and considering the effects of federal programs on prime, unique, or farmlands of local or statewide importance. Farmlands are defined by the presence of specific prime, unique, and local or statewide important farmland soil types, the location of the parcel in relation to municipal limits, and the size of the tract of land. Figure 4.4 displays the locations of lands underlain by prime and unique farmland soils. Largely undeveloped and contiguous, many parcels are considered prime farmlands. Table 4.4 displays the acreage of prime and unique farmland soils, by corridor.

Table 4.4. Prime and Unique Farmland Soil Acreage by Alternative

Alternative	Prime and Unique Farmland Soils (Acres)
1	1,685
1A	1,685
2	1,090
3	1,085
4	1,365
5	305
6	1,215
6A	1,290
7	1,390
7A	1,380

Notes: Acreage estimates based on conservative 300-foot right-of-way assumption and are rounded to the nearest 5 acres. Actual right-of-way requirements should range between 115 and 250 feet, depending upon the local alignment constraints and the planned roadway section.

Sources: U.S. Department of Agriculture. Various dates. Soil Surveys for Terrebonne, Lafourche, Assumption, St. James, St. John the Baptist, and Ascension parishes. Natural Resources Conservation Service (formally the Soil Conservation Service). Digitized by URS Greiner Woodward Clyde in September 1998.

Figure 4.4 Prime and Unique Farmland Soils

See filename FIG4_4.PDF

This figure displays the locations within the study area of soils that have been designated by the Natural Resources Conservation Service as prime or unique farmland soils in the State of Louisiana. All prime and unique farmland soils locations are presented in relation to the preliminary alternative corridors.

4.2.2. Coastal Zone and Floodplains

The Coastal Area Management Act requires that all coastal areas develop a coastal zone management plan that delineates areas of environmental concern. Coastal zone boundaries in the project area are located on Figure 4.5, which also displays the locations of the 100-year and 500-year floodplains. These coastal zones signify areas within which coastal development permits would be required for minor or major developments. All alternatives traverse Louisiana's coastal zone; however, Alternatives 1, 1A, 3, and 4 encroach the coastal zone less than the alternatives that traverse the wetland area south of LA 3127. Alternatives that include improvements to LA 3127 (i.e., Alternatives 6, 6A, 7, and 7A) would traverse the greatest linear distance of coastal zone because LA 3127 is located wholly within St. James Parish, a parish in the coastal zone.

The elevations of lower southeastern and south central Louisiana hover near sea level. Consequently, a large portion of the study area is susceptible to flooding during storms of average 100-year recurrence (i.e., the 100-year storm), which is the storm that has a one percent chance of being equaled or exceeded in any given year. Areas outside of the 100-year storm event are typically located in the higher elevations along the upland ridges as displayed in Figure 4.5. Efforts to utilize existing upland ridges were made where possible with all alternatives. As illustrated in Figure 4.5, alternatives that follow existing upland ridges traverse the fewest linear feet of 100-year floodplain. These alternatives include Alternatives 1, 1A, and 3. Alternative 2 is likewise located on an upland ridge and is largely outside of the 100-year floodplain. The only new location construction alternative that would not traverse substantial lengths of the 100-year floodplain is

Figure 4.5 Floodplains and Coastal Zone

See filename FIG4_5.PDF

This figure displays the location of the 100-year and 500-year floodplains, and the Louisiana Department of Natural Resources, Coastal Management Division's designated coastal zone, in relation to the preliminary alternative corridors.

Alternative 4, which follows the northern edge of the Bayou Lafourche ridge, north-northeast of LA 308. However, between Relocated US 90 and LA 1/LA 308, this alternative also traverses a portion of the 100-year floodplain. Alternative 5 crosses the greatest distance of 100-year floodplain.

Although the 100-year floodplain covers most of the project area that is not located along the upland ridges, most of the wetland areas that are located in the 100-year floodplain would be bridged with an elevated facility as assumed and discussed in Section 2.0 of this report. Therefore, that an alternative's alignment is located within the 100-year floodplain should not preclude the alternative from further consideration. Furthermore, any at-grade section located within the 100-year floodplain would be raised above the floodplain as part of the project.

4.2.3. Industrial and Potentially Hazardous Sites

A limited environmental inventory was conducted for the study area to determine the locations of underground storage tanks; hazardous waste generators, storers, transporters; and hazardous waste sites that have been identified for cleanup. This limited site search did not constitute a full Phase I Environmental Assessment. Several databases were not readily available in GIS format but should be reviewed during additional analysis of the reasonable and feasible alternatives in future study. Databases that were not reviewed include the Leaking Underground Storage Tank database, the Environmental Response Notification System database, and others.

The Underground Storage Tank database, the Resource Conservation and Recovery Act Information System List (RCRIS) and the Comprehensive Environmental Resource Cleanup Liability Act Information System List (CERCLIS) were accessed through the EPA's database, Envirofacts. Figure 4.6 displays the locations of these sites within the study area. As expected, the concentrations of underground storage tanks reflect the concentrations of service stations and convenience stores throughout the study area, with the highest concentrations located along existing routes within developed communities. Similarly, RCRIS sites are also located along these corridors. Only one CERCLIS site is located near the study area. Actually located south of Relocated US 90 and outside of the expanded study area, this site is outside of the alternative corridors but in proximity to the Alternative 5 corridor.

Based on the locations of these recorded sites, new location construction alternatives (Alternatives 4, 6, 6A, 7, and 7A) would pose the least potential for encroaching unrecorded hazardous waste sites and leaking underground storage tanks. Alternative 3, which would require new right-of-way along LA 308 to accommodate a four lane section, would have the greatest potential for affecting such sites.

Figure 4.6 Underground Storage Tanks & Potentially Hazardous Sites

See filename FIG4_6.PDF

This figure displays the locations of Resource Conservation and Recovery Act Information System (RCRIS) database sites, hazardous waste sites on the Comprehensive Environmental Resource Cleanup Liability Information System (CERCLIS) List, and underground storage tanks (USTs), in relation to the preliminary alternative corridors.

4.3 Natural Environment

4.3.1. Surface Waters

As illustrated in Figure 2.3 (Preliminary Alternatives with Satellite Image) located in Section 2.0 of this document, the study area is woven with streams, bayous, rivers, wetlands, canals, and lakes. Figure 4.7 displays the locations of substantial surface waters and waters recognized as navigable waterways.

The most prominent surface water features in the study area are the Mississippi River, Bayou Lafourche, Lake Des Allemands, and Lake Bouef. Alternatives 1, 1A, and 3 maintain existing waterway crossings and would not require additional crossings. The greatest number of new waterway crossings would be required for Alternatives 7 and 7A, which each require four new crossings.

Table 4.5. Crossings of Substantial Surface Waters and Navigable Waters

Alternative	Total New Surface Water Crossings	Navigable Waterway Crossings of Total New Surface Water Crossings
1	0	0
1A	0	0
2	0	0
3	0	0
4	1	1
5	2	0
6	3	1
6A	2	1
7	4	1
7A	4	1

Notes: Navigable waters are waters that are used for commerce and are regulated by the United States Coast Guard. Waters that are not currently recognized as navigable can be declared navigable by the U.S. Coast Guard with evidence supporting that the waterbody is used for commerce. Surface water crossings noted in the table above refer to crossings of substantial waterbodies. The number of other surface water crossings (i.e, small canals, small bayous, drainage swales, and others) is not provided. For this analysis, it was assumed that new surface water crossings would require a bridge-structure unless the crossing is located along an alternative corridor's section that is assumed to be an elevated roadway.

Sources: Louisiana Department of Transportation and Development. Surface waters recognized by the LDOTD as Navigable Waters as provided by GeoQuery , Inc. in December 1998; Braud, DeWitt H. Jr. 1997. Satellite View of Louisiana from the Merge of Landsat Thematic Mapper and Spot Imagery. Louisiana Department of Environmental Quality and the Department of Natural Resources: Baton Rouge, La. In association with the U.S. Geological Survey's National Wetlands Research Center in Lafayette, LA; URS Greiner Woodward Clyde. Digitized line drawings of surface waters in Louisiana. Obtained in December 1998 and verified for reasonable accuracy in January 1999.

Figure 4.7 Surface Water & Navigable Waterways

See filename FIG4_7.PDF

This figure displays the locations of substantial waterbodies and provides a list of waterbodies recognized by the Louisiana Department of Transportation as navigable waterways, in relation to the preliminary alternative corridors.

4.3.2. Wetlands

Although readily available, secondary data for wetlands in southeastern Louisiana are generally inaccurate. While National Wetland Inventory maps and soil surveys were reviewed to determine approximate locations of wetlands in the study area., aerial infrared photography was the primary tool used to identify likely wetland communities and boundaries. Identified areas were digitized into a GIS layer for use with this project. Figure 4.8 displays the locations of wetlands within the study area identified by this method. It should be noted that the locations of wetlands outside of the general study area were not delineated, and are therefore not shown on Figure 4.8.

Wetlands in the area are dominated by cypress-tupelo swamps although some native bottomland hardwood forest wetlands and freshwater marshes are present in the area. Wetlands in the study area are vast and contiguous, serving many functions including, floodwater attenuation, wildlife and fisheries habitat, and surface water pollutant removal. The values of some wetlands appear high, due to their contiguous nature, size, quality, and functions.

Wetland impacts were initially determined for the entire 1,000-foot corridors. To provide a more realistic magnitude of projected impacts, by Alternative, it was determined that a realistic right-of-way requirement should be assumed for the calculation of projected wetland impacts. For most areas traversing wetlands, it was assumed that the required right-of-way would be minimized to 115 feet. In other areas, this required right-of-way was 150 feet. As noted in Section 2.0 of this report, it was assumed that substantial,

Figure 4.8 Wetlands

See filename FIG4_8.PDF

This figure displays the locations, within the study area only, of wetlands, in relation to the preliminary alternative corridors. Wetlands identified in this figure are based solely on the interpretation of satellite image and high-altitude, color aerial infrared photography.

contiguous wetlands traversed by the alignments of alternatives would be crossed via an elevated roadway. This simulated, assumed roadway would have spans of approximately 89 feet long and 50 feet wide and would impact the underlying wetlands in two manners: 1) by filling and deplacing vegetation within the footprint of the span piers; and 2) by shading wetland vegetation located under the elevated roadway in areas not affected by filling from the piers. Table 4.6 provides these two estimates.

Table 4.6. Wetlands Affected by Permanent Filling and Shade

Alternative	Wetlands Affected by Filling (Acres)	Wetlands Affected by Shading of Elevated Structures (Acres)
1	50	0
1A	50	0
2	170	0
3	125	0
4	145	30
5	65	185
6	285	115
6A	285	130
7	315	45
7A	280	85

Notes: Estimates of wetland impacts are based on minimum right-of-way requirements (i.e., 115 feet in elevated sections, and 150 feet for at-grade sections). Additionally, only the footprints of elevated roadway piers were aggregated to determine fill impacts for elevated sections. Fill impacts for at-grade sections based on fill from shoulder to shoulder. Permanent shading impacts would occur only for elevated sections. It was assumed that the area located under the elevated structure that was not filled for pier footings would be affected by permanent shade. For calculation purposes, the average span length was measured to be 80 feet. Acreage estimates are rounded to the nearest 5 acres.

Sources: Braud, DeWitt H. Jr. 1997. Satellite View of Louisiana from the Merge of Landsat Thematic Mapper and Spot Imagery. Louisiana Department of Environmental Quality and the Department of Natural Resources: Baton Rouge, La. In association with the U.S. Geological Survey's National Wetlands Research Center in Lafayette, LA; URS Greiner Woodward Clyde. Digitization of wetlands based on aerial infrared photography. Completed in September 1998.

Should a new location corridor be carried through for further study and consideration as the preferred alternative to meet the project need, additional efforts would be made to identify the locations and extent of wetlands. Where possible, the alignment of the alternative would be revised to avoid wetland impacts. Where design or other considerations make avoidance of wetlands along the corridor impossible, impractical, or unsafe, the alignment would be revised to minimize the impacts to the wetlands as

practicable. Finally, impacts to wetlands that were unavoidable and minimized to the extent practicable would be mitigated by a combination of wetland restoration, creation, enhancement, and preservation.

Wetland mitigation planning is site specific and impossible to accurately plan at this early phase of a project. For this project, an attempt to account for these difficult-to-estimate costs was made by assuming that the USACE would allow mitigation to wetland impacts to be comprised of only wetland preservation. Discussion with the U.S. Army Corps of Engineers suggests that a wetland replacement ratio for such valuable wetlands could be as high as three replacement wetlands for each impacted wetland. That is, for every one acre of wetland impact affected by the project, the USACE could require up to three acres be replaced to compensate for the impacted acre's loss. Cursory wetland impact mitigation costs (comprised of preservation acreage purchases) were developed for each alternative. Discussion of the method to develop these costs and the projected costs of wetland preservation banking is provided in Section 2.0 of this report. Detailed wetland delineations and impact estimates would be provided following additional study of the alternatives.

4.3.3. Wildlife, Fisheries, and Protected Species

Louisiana Department of Natural Heritage Program digital GIS data were reviewed to determine the locations of wildlife management areas, significant natural areas, colonial waterbird nesting sites, and protected species occurrences. Review of these databases and GIS data layers revealed that there are no wildlife management areas or significant

natural areas located within the study area boundaries. For site security reasons, specific locations of waterbird nesting sites and the types and locations of protected species occurrences cannot be shown in public documents. However, based on suggestion of the Louisiana Natural Heritage Program, areas of relatively high concentration of occurrences of Louisiana Natural Heritage Program sensitive sites are identified with shaded areas in Figure 4.9. This figure displays four such areas where relatively high concentrations of waterbird nesting sites and/or protected species (flora and fauna) occurrences have been recorded. Alternatives 2, 5, 6A, and 7 all traverse the edge of one such area. Alternatives 1, 1A, 3, 4, 6 and 7A do not encroach any of these areas; however, the widening of LA 641 between the Gramercy-Wallace Bridge and I-10 (a project included in Alternatives 6, 6A, 7 and 7A) is located directly west of one of these areas of concern.

New location alternatives 5, 6, 6A, and 7A would bisect the large wetland tract located between LA 3127 and Bayou Lafourche; however, the elevated spans planned for this crossing would allow wildlife to migrate, avoiding substantial fragmentation of this contiguous habitat. Wildlife that are wary of human activity may avoid the area bordering and underlying the new elevated facility, effectively limiting their range. Large terrestrial mammals such as whitetail deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*) are particularly sensitive to such habitat fragmentation or intrusion.

Figure 4.9 Sensitive Biological Resources

See filename FIG4_9.PDF

This figure displays the locations of regions within the study area that have a higher than average concentration of colonial waterbird nesting sites and/or protected species. However, because of site-security reasons, this figure does not include the specific locations or descriptions of sites within each identified region.

Alternative 4 would isolate a relatively narrow strip of agriculture and undeveloped upland between LA 308 and the new facility, which would effectively fragment this upland by providing a potential barrier or deterrent for terrestrial animals to reach these upland areas from the wetland areas north. New location alignments south of Bayou Lafourche would create similar problems, with minimal undeveloped upland in the area. Despite these potential effects, no substantial fragmentation or adverse effects to wildlife are anticipated from such a project should sufficient consideration be given to maintaining wildlife corridors.

5.0. CONCLUSIONS

5.1 Non-Structural Alternatives

Due to the intended project purpose of hurricane evacuation, typical Travel Demand Management (TDM) alternatives such as car pooling, van pooling and transit options were not considered. However, through the evaluation, it was noted that some benefits may be derived from implementation of an upgraded motorist information system utilizing advanced technology and communications capabilities. While certain hurricane evacuation routes are in high demand and experience substantial delay, other routes may be under-utilized. Also, incidents and construction zones on evacuation routes can reduce roadway capacity and result in substantial delays and inefficiencies during evacuation events.

The ability to disseminate real time traffic and roadway information regarding designated hurricane evacuation routes could result in better utilization of the entire hurricane evacuation network and improve evacuation efficiency. Real time traffic information can be acquired through communication with law enforcement patrols, speed detection sensors and closed-circuit television surveillance at critical locations on Hurricane Evacuation Corridors. Some options for disseminating this information to the public include variable message signs, highway advisory radio, web sites with real time traffic conditions, and improved real time traffic broadcast from radio and TV stations.

5.2. Alternatives Dismissed From Further Consideration

The identified constraints and anticipated adverse and beneficial effects of all alternative corridors were compared in order to refine the scope of further study to only those alternative corridors that are evaluated as both feasible (i.e., constructable and effective in addressing the need for the project) and reasonable (i.e., potential for public consensus and environmentally responsible). Some of the alternatives developed for consideration were evaluated as either ineffective at addressing the primary transportation objective of improving hurricane evacuation efficiency or unreasonable for environmental, social or a combination of factors when compared to other less impacting alternatives.

The following is a list of key considerations for evaluating corridors for reasonableness and feasibility:

1. Improves hurricane evacuation efficiency.
2. Uniformly distributes traffic to critical hurricane evacuation links.
3. Provides options and flexibility in accessing primary hurricane evacuation routes and designated shelter zones to the north.
4. Provides access to Alternative Corridor(s) from population centers within the service area.
5. Provides reasonable project costs and capability to-phase-in alternative.
6. Avoids/Minimizes wetland impacts and utilizes of upland ridges.
7. Avoids/Minimizes impacts to cultural resources.
8. Avoids/Minimizes community facilities, residences and businesses.

Table 5.1 summarizes the results of this evaluation.

Table 5.1 Summary of Alternative Corridors Considerations

See filename TABLE5_1.PDF

This table summarizes all factors that were considered in the study's evaluation of the preliminary alternatives and provides these considerations in a matrix, by alternative. This table is identical in data and format to that of Table S.1.

Future study of reasonable and feasible alternatives will necessarily include an evaluation of the No Action or No Build Alternative as a reference to which the effects of future action alternatives will be compared.

Alternatives that were eliminated from further consideration for future analysis are discussed below, with the reasons why each alternative was dismissed from further consideration.

5.2.1. Alternative 1

Located on existing alignment, Alternative 1 would have the least right-of-way requirements; however, this alternative would have the greatest temporary construction delays and associated inconveniences and would be ineffective at addressing the primary transportation objective of improving hurricane evacuation efficiency. Despite its lowest overall costs, this alternative was eliminated from further consideration as a feasible alternative corridor because of its ineffectiveness in addressing the primary transportation purpose and need of the project.

5.2.2. Alternative 1A

Similar to Alternative 1, Alternative 1A is also located on existing alignment, but would include operation of LA 308, and segments of LA 70 as a two-lane outbound only facility (reversible) during hurricane evacuation events, substantially increasing LA 308's capacity. While Alternative 1A would also need little additional right-of-way, this alternative is not effective in achieving the primary purpose and need for this project,

which is improving hurricane evacuation efficiency as documented in the transportation modeling results. This alternative would also require LA 308 and LA 70 be operated as a two-lane outbound reversible facility during hurricane evacuation events. Due to the uncontrolled-access characteristics of these arterials, significant manpower requirements would be needed for safe and efficient operations. In discussions with both state and local law enforcement agencies, it was noted that manpower resources were limited and in very high demand during hurricane evacuation events. It was basically implied that operating that length of LA 308 and LA 70 as a two-lane outbound reversed facility, considering the uncontrolled access nature of the roadway and the level of development along the roadway, would be virtually impossible with the limited manpower resources of both state and local law enforcement agencies during hurricane events. Therefore, Alternative 1A was also dismissed from further consideration as a feasible alternative corridor for further study.

5.2.3. Alternative 2

Alternative 2 does provide some improvements to the transportation system efficiency during hurricane evacuation events as noted in the transportation modeling analysis. However, implementation of Alternative 2 would require substantial additional right-of-way along densely populated segments of LA 20 and the Chackbay Ridge. It is likely that this alternative would result in numerous relocations of residences, businesses and potential impacts to community facilities. Given the low level of community consensus support documented for this alternative and potential community cohesion concerns to

adjacent communities along LA 20, this alternative was eliminated from further consideration as a reasonable and feasible alternative.

5.2.4. Alternative 3

Alternative 3 follows the same alignment of Alternatives 1 and 1A. The transportation model indicates that this alternative provides very minimal, if any, real transportation efficiency improvements during hurricane evacuation events. This alternative would include widening LA 308 from two lanes to a four-lane rural or urban section with substantial additional right-of-way being required, (unlike Alternatives 1 and 1A). LA 308 is generally developed throughout the project study area, with some densely developed segments. The final alignment within this corridor would likely require more residential and business relocations than any other final alternative alignment of all alternatives considered. Additionally, this alternative would have the greatest potential for adversely affecting sites listed in or eligible for listing in the National Register of Historic Places. Due to very limited community support for this alternative, the potential number of relocations and potential community cohesion concerns, Alternative 3 was omitted from further consideration as a reasonable alternative corridor to meet the primary transportation objective of this project.

5.2.5. Alternative 5

The shortest but most expensive alternative corridor under consideration, Alternative 5 spans the entire length of the wetlands between Bayou Lafourche and LA 3127 via an elevated highway. This alternative corridor passes through one and within close

proximity of another area with a relatively high concentration of federally and/or state-protected species occurrences and/or waterfowl nesting areas. This alternative also leads directly to the Gramercy-Wallace Bridge via a controlled-access elevated facility. Alternative 5 would attract and direct significant volumes of traffic directly to the Gramercy-Wallace Bridge, creating an uneven distribution of evacuation traffic between the Sunshine and Gramercy-Wallace bridges. However, due to the remote eastern point of access to the facility from population centers to the west, there is a substantial increase in congestion on US 90 westbound, rendering this alternative somewhat ineffective. Considering this and because of the relatively excessive potential environmental impacts relative to other alternative corridors under consideration, the Alternative 5 corridor was dismissed from further consideration as a reasonable alternative corridor for further study.

5.3 Preferred Hurricane Evacuation Alternative Corridor(s)

Based on the stated primary purpose and need of improving hurricane evacuation efficiency, and the documented evaluation considerations, Alternative Corridors 6, 6A and 7A appear to be the most effective and reasonable. All three of these alternative corridors are on new location as shown in Figure 5-1. Alternative Corridors 6 and 6A originate at relocated US 90 to the south and traverse the Little Bayou Black Ridge northward paralleling LA 311 to the Lafourche Ridge and LA 1 just west of the Thibodaux Bypass (LA 3185). Both Alternative Corridors 6 and 6A are identical to this point. Once north of Bayou Lafourche both alternative corridors proceed northward to

Figure 5.1 Preferred Hurricane Evacuation Corridors

See filename FIG5_1.PDF

This figure displays the location and alignment of the preferred alternative corridors: Alternatives 6, 6A and 7A. This figure also emphasizes that the alignment of the preferred alternative corridor through the wetland area between the Mississippi River and Bayou Lafourche cannot be accurately estimated at this time, by substantially widening the corridors of these alternatives through this wetland area.

LA 3127; however, Alternative Corridor 6A intersects LA 3127 slightly to the west of Alternative Corridor 6.

Alternative Corridor 7A originates at Relocated US 90 near the LA 316 interchange and extends northward along the Bayou Blue Ridge, intersecting LA 1 just to the east of Thibodaux. From LA 308, Alternative Corridor 7A jogs slightly to the west and then extends northward bisecting LA 3127 at a mid point between the Sunshine and Gramercy-Wallace bridges.

Consistent with the previously documented Transportation Modeling Analysis in Section 3.0 of this report, these alternative corridors provide a relatively uniform distribution of traffic to critical links during hurricane evacuation events. These alternatives appear to maximize efficiency and utilization of the critical hurricane evacuation network by effectively utilizing the proposed improvements and existing routes including the LA 1 and LA 308 corridor, LA 3127, and the Sunshine and Gramercy-Wallace bridges.

The southern termini of these alternative corridors are easily accessible and in close proximity to population centers. These alternative corridors also provide hurricane evacuation options and good flexibility in accessing designated hurricane evacuation shelter zones to the north, as well as other prominent hurricane evacuation routes to the north including I-10, I-12, I-55, I-59, US 61 and US 190.

These alternative corridors reside on primarily undeveloped and/or agricultural lands. The environmental inventory analysis suggests that very minimal impacts to community and cultural resources would be incurred from these alternative corridors. Residential and business relocations associated with all three alternative corridors are also anticipated to be minimal, consistent with the environmental inventory.

Each of these alternatives also effectively utilizes the natural upland ridge system to the maximum extent possible, resulting in avoidance and minimization of impacts to wetlands resources. Alternatives 6 and 6A utilize the Little Bayou Black Ridge between relocated US 90 and the Lafourche Ridge. Alternative 7A utilizes the Bayou Blue Ridge effectively between Relocated US 90 and Bayou Lafourche. North of LA 308, these alternatives utilize the Lafourche and Chackbay Ridges to the maximum extent possible before transitioning to an elevated roadway section to minimize impacts to the vast forested wetlands between the Lafourche Ridge and LA 3127.

As documented in Section 2.8.4 the total estimated project costs including construction, engineering, administrative, right-of-way, mitigation and contingencies for these three alternatives ranges from $313 million to $404 million. However, it should be noted that these are total project costs for a network extending from Relocated US 90 to I-10, which includes a vast array of improvements including constructing a new approach connector to the Gramercy-Wallace Bridge from LA 3127, widening LA 641 to I-10, upgrading LA 3127 between the Sunshine Bridge and the Gramercy-Wallace Bridge and building a new four-lane facility from Relocated US 90 to LA 3127. It is important to note that this

"total project" can be phased over an extended period of time with critical interim phases providing the greatest benefits from the initial, crucial phases. This allows the cost of the project to be distributed over an extended period of time, increasing the potential fiscal feasibility of the project.

Each of the three identified preferred hurricane evacuation alternative corridors was evaluated for logical phasing options to determine the most beneficial segments (projects) and a logical sequence for implementation. By utilizing a phased or staged approach to implementation, the most beneficial segments of the project can be implemented first. Also, with a phased implementation, full capital funding for the entire project is not required initially, and phases can be scheduled and programmed more consistent with anticipated funding resources availability. The results of this evaluation revealed that there are "Interim Alternative Concepts" that could provide significant hurricane evacuation benefits while minimizing initial costs.

An "Interim Alternative Concept" was developed for each of the preferred hurricane evacuation alternative corridors. They are similar and are generally described by partially implementing the three most critical segments of the preferred alternative corridors including:

1) Construction of a new connector roadway from LA 3127 to the Gramercy Wallace-Bridge.

2) Implementation of a new two-lane roadway from LA 3127 to LA 1 (substantial portion will be elevated).

3) Implementation of a new two-lane roadway from LA 1 to Relocated US 90.

These three segments would need to be implemented with reasonable control of access in order to enable operation of an outbound reversible lane facility with minimal manpower requirements. Development and design of this type of facility would require close coordination with, and support of, local and state law enforcement agencies and a well developed Traffic Management Plan. By utilizing reasonable control-of-access measures, intelligent transportation systems technology, and proper planning, a Traffic Management Plan can be devised that minimizes manpower requirements from local and state law enforcement agencies and that allows for implementation and operation of the reversible facility concept for hurricane evacuation events.

Implementing these “Interim Alternative Concepts” for each of the preferred alternative corridors was evaluated using the preliminary cost estimates, by segment. Table 5.2 is a listing of each preferred alternative corridor’s costs, by interim alternative critical segments.

Table 5.2. Interim Alternative Program Cost for Preferred Hurricane Evacuation Alternatives Corridors

Alternative	Improvement Description	Project Legnth (mi.)	Total Project Cost minus Mitigation ($Millions)
6	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
6	LA 308 to LA 3127: Elevated New 2-Lane Road	7.6	86.0
6	LA 308 to LA 3127: New 2-Lane Road	3.3	8.6
6	US 90 to LA 308: Elevated New 2-Lane Road	2.9	33.0
6	US 90 to LA 308: New 2-Lane Road	7.0	25.4
Total			**175.5**
6.A	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
6.A	LA 308 to LA 3127: Elevated New 2-Lane Road	8.7	92.1
6.A	LA 308 to LA 3127: New 2-Lane Road	2.8	8.1
6.A	US 90 to LA 308: Elevated New 2-Lane Road	2.9	33.0
6.A	US 90 to LA 308: New 2-Lane Road	7.0	25.4
Total			**181.1**
7.A	LA 3127 and G-W Bridge: New 4-Lane Road	3.5	22.5
7.A	LA 1/LA 308 to LA 3127: Elevated 2-Lane New Road	7.6	86.0
7.A	LA1/LA 308 to LA 3127: New 2-Lane Road	4.6	6.3
7.A	US 90 to LA1/LA 308: New 2-Lane Road	9.3	22.4
Total			**137.2**

Notes: Projects listed comprise the Interim Alternative Concept of the fully-envisioned alternatives as described in Section 2.0 of this report. Full Alternative costs are described in Section 2.0 of the report.

Source: Original cost calculation data sources on tables 2.2 through 2.5 of this report.

Table 5.2 indicates that the preliminary estimated costs to implement these "Interim Alternative Concepts," which vary from approximately $137 million to $181 million, approximately 40 percent of the estimated total project costs. It is important to note that each of these critical segments except for the LA 3127/Gramercy-Wallace Bridge connector project, can be phased by providing only a minimum two-lane facility in the interim, further reducing total up-front capital expenditure costs. Based on the transportation modeling analysis the following priority phasing is recommended:

4) Construction of a new connector roadway from LA 3127 to the Gramercy-Wallace Bridge.

5) Implementation of a new two-lane roadway from LA 3127 to LA 1.

6) Implementation of a new two-lane roadway from LA 1 to Relocated US 90.

Ultimately, additional phases of the chosen alternative can be implemented over time, consistent with available funding levels, until the fully-envisioned alternative is constructed. Additional analysis would be required to determine the feasibility of these Interim Alternative Concepts.

The following is a summary of the primary reasons that Alternative Corridors 6, 6A and 7A were identified as the preferred hurricane evacuation alternative corridors:

8) These alternatives most effectively meet the stated purpose and need of improving the efficiency of the hurricane evacuation transportation network and generally the efficiency of hurricane evacuation events within the defined service area.

9) Considering the two defined northbound hurricane evacuation critical links (the Sunshine and Gramercy-Wallace bridges), these alternatives provide a relatively uniform distribution of hurricane evacuation traffic demand, maximizing the efficient utilization of these critical links.

10) Each of these Alternative Corridors effectively utilizes the upland natural ridge system within the study area to minimize impacts to wetland areas.

Where expansive wetland areas would be traversed, elevated roadway sections are assumed in order to minimize impacts to wetland areas.

11) Each of these alternative corridors primarily entails construction on new location in undeveloped or sparsely developed corridors, resulting in the minimization of impacts to community and cultural resources.

12) Good access and proximity to population centers within the service area are provided by each of these alternative corridors.

13) Each provides options and good flexibility in accessing designated hurricane evacuation shelter zones to the north, as well as other primary hurricane evacuation routes to the north of the study area.

14) Each of these alternatives provides the opportunity for a phased-implementation approach in which defined interim alternatives ("Interim Alternative Concepts") could be developed that could potentially provide significant hurricane evacuation benefits while greatly minimizing initial costs.

5.4 Other Considerations

The primary purpose and need for this study was defined as hurricane evacuation. When evaluating all of the alternatives corridors developed for consideration solely based on the hurricane evacuation purpose and need for this project, Alternative Corridors 6, 6A and 7A rate similarly and better than the other alternative corridors and are, therefore, considered the preferred alternative corridors. However, there are other secondary purpose and need issues that local community governments, agencies and other

stakeholders have expressed and may want considered in future evaluations. If the purpose and need for this project is modified, the preferred alternative corridor recommendations in this study may need to be modified to be consistent with changes in the stated purpose and need for the project.

Two of the alternative corridors (Alternatives 4 and 7) considered in this analysis were not explicitly eliminated from consideration in Section 5.2 nor were they included as preferred alternative hurricane evacuation corridors. Because modifying the documented purpose and need of the project is a consideration, these alternatives are noted for further consideration, contingent on this potential modification of the project purpose and need.

Alternative Corridor 4 parallels the Little Bayou Black Ridge between Relocated US 90 and LA 1 and extends west-northwest along the northern fringe of the Lafourche Ridge to the Sunshine Bridge. This alternative corridor is on new location and would provide an efficient route toward the Baton Rouge Metropolitan Area. Comparatively, this is one of the lower cost options. It also effectively utilizes the natural upland ridges, resulting in the least wetland impacts of any new location alternative. Because of this, elevated roadway segments are greatly minimized, and project costs are reduced. Regarding hurricane evacuation efficiency, this route reduces flexibility in hurricane evacuation options by aligning a disproportionately high volume of traffic to the Sunshine Bridge, and under-utilizing the Gramercy-Wallace Bridge. In essence, both primary northbound hurricane evacuation corridors servicing the region (LA 1/308 and Alternative 4) would

lead to the same critical link, the Sunshine Bridge, reducing evacuation options and potentially creating more significant capacity problems.

Alternative 7 is identical to Alternative 7A between Relocated US 90 and LA 308. However, north of LA 308 Alternative 7 parallels the Laurel Valley Ridge, north-north eastward towards LA 20, intersecting LA 3127 well to the east of Alternative 7A, in much closer proximity to the Gramercy-Wallace Bridge. Utilizing the Laurel Valley Ridge and an existing north/south segment of LA 20 to the Vacherie Ridge reduces the distance of roadway traversing wetlands, and in-turn reduces the length of elevated roadway and associated costs. The result is a comparatively low cost alternative that minimizes community and environmental impacts.

This alternative would provide some flexibility and latitude in northbound hurricane evacuation options. It was developed in an attempt to distribute traffic evenly between northbound hurricane evacuation critical links (i.e., the LA 1/Sunshine Bridge corridor and the Gramercy-Wallace Bridge corridor). However, the hurricane evacuation transportation model has indicated that this alternative is neither as effective nor as efficient in distributing traffic between northbound critical hurricane evacuation links as alternatives that intersect LA 3127 farther west or at a more central location relative to the two Mississippi River Bridge crossings (i.e., Sunshine Bridge and the Gramercy-Wallace Bridge).

6.0. REFERENCES

Braud, DeWitt H. Jr. 1997. Satellite View of Louisiana from the Merge of Landsat Thematic Mapper and Spot Imagery. Louisiana Department of Environmental Quality and the Department of Natural Resources: Baton Rouge, La. In association with the U.S. Geological Survey's National Wetlands Research Center in Lafayette, LA.

Hazards Management Group, Inc. 1990. *Southeast Louisiana Hurricane Evacuation Study Behavioral Analysis*. Tallahassee, Fla. Prepared for the U.S. Army Corps of Engineers.

Irwin, M. D. and J. S. Hurlbert. *A Behavioral Analysis of Hurricane Preparedness and Evacuation in Southwestern Louisiana.* Final Report, Submitted to the Louisiana Office of Emergency Preparedness. Louisiana State University, Population Data Center and Survey Research Lab. September 1995.

Louisiana Department of Culture, Recreation, and Tourism. Recorded Archaeological and Historic Structure and Property Sites in selected parishes in Louisiana. Data cited by C. Goodwin Associates in the Draft Report titled, *LDOTD Project No. 700-99-0132, Hurricane Evacuation Corridor Study to Connect Relocated US 90 to LA 3127, Terrebonne, Lafourche, and St. James Parishes, Louisiana.* September 1998.

Louisiana Department of Natural Resources. Coastal Zone Boundary Map. Division of Coastal Management. 1998.

Louisiana Department of Transportation and Development. Property Type Classes, Valuation Factors, and Adjustment Factor. Received from Real Estate Office in a letter dated January 11, 1999.

Louisiana Natural Heritage Program. 1998. Federal- and State-Protected Species Occurrences, Locations of Waterbird nesting sites, significant natural areas, wildlife management areas, and other Louisiana Natural Heritage Program recorded environmentally sensitive sites in Louisiana. 1998.

Post, Buckley, Schuh & Jernigan, Inc. *Transportation Model Support Document. Southeast Louisiana Hurricane Evacuation Study*. Draft Report. Prepared for the New Orleans District, U.S.Army Corps of Engineers. May 1992.

R. Christopher Goodwin Associates. *LDOTD Project No. 700-99-0132, Hurricane Evacuation Corridor Study to Connect Relocated US 90 to LA 3127, Terrebonne, Lafourche, and St. James Parishes, Louisiana. Draft Cultural Resources Findings Report.* New Orleans, La. September 1998.

Renwick, E. F. *Opinions and Attitudes of the Voters of Jefferson Parish, The State of Louisiana, Regarding Selected Issues and Personalities*. October 1998.

URS Greiner Woodward Clyde. *Transportation Analysis for State Project No. 700-99-0132 for Terrebonne, Lafourche, Assumption, St. James, St. John the Baptist, St. Charles Parishes, Louisiana*. Prepared for the LDOTD. January 1999.

U.S. Army Corps of Engineers. Telephone conversation with an environmental specialist at the New Orleans District regarding wetland mitigation ratios on January 15, 1999.

U.S. Department of Agriculture. 1976. *Soil Survey for Ascension Parish*. Natural Resource Conservation Service [formerly known as the Soil Conservation Service].

U.S. Department of Agriculture. 1978. *Soil Survey for Assumption Parish*. Natural Resource Conservation Service [formerly known as the Soil Conservation Service].

U.S. Department of Agriculture. 1981. *Soil Survey for Lafourche Parish*. Natural Resource Conservation Service [formerly known as the Soil Conservation Service].

U.S. Department of Agriculture. 1960. *Soil Survey Terrebonne Parish.* Natural Resource Conservation Service [formerly known as the Soil Conservation Service].

U.S. Department of Agriculture. 1973. *Soil Survey for St. James and St. John the Baptist Parishes*. Natural Resource Conservation Service [formerly known as the Soil Conservation Service].

U.S. Department of Commerce. 1990 Census Block Statistics for Louisiana. STF-1 on CD-ROM.– Washington: The Bureau, 1992.

U.S. Department of Commerce. 1990 Tiger/Line Files for Louisiana based on Summary Tape File 3 on CD-ROM. Prepared by the Bureau of the Census – Washington: The Bureau, 1992.

U.S. Environmental Protection Agency. Data from the EPA Regulated Facility Point Locations from Envirofacts for the Coterminous U.S. Downloaded at FTP.EPA.GOV/pub/spdata/ef. Metadata reference site: http: //nsdi.epa.gov/nsdi/projecs/nat enviro.htm.

U.S. Geological Survey, 1997. Geographic Names Information System Data for selected parishes in Louisiana.